CERAMIC ABSTRACTS and THE BULLETIN

AMERICAN CERAMIC SOCIETY

AUGUST 15, 1942

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES

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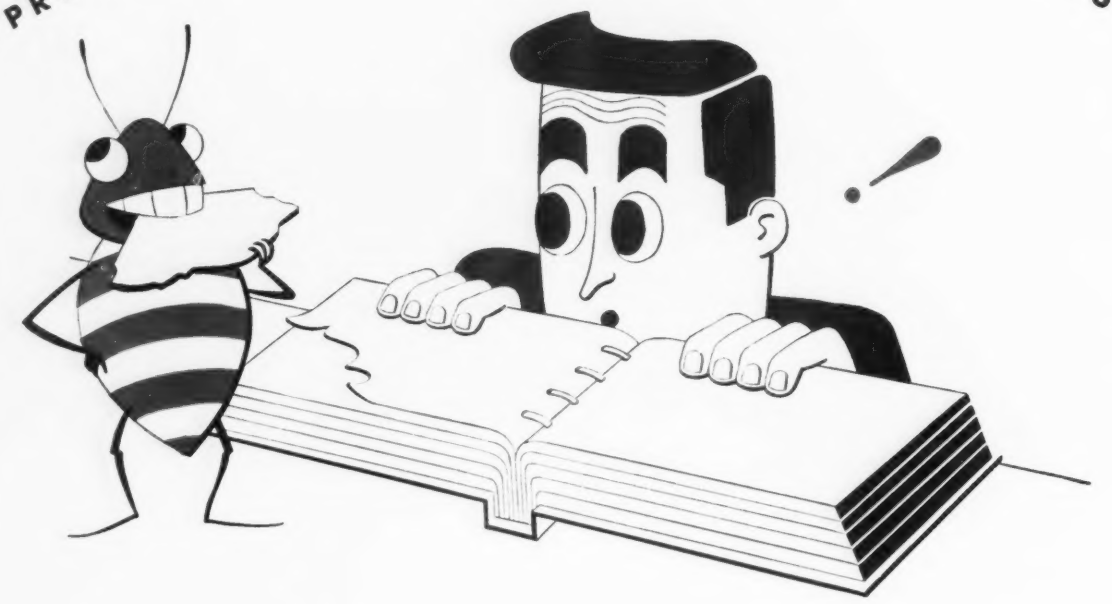

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TABLE OF CONTENTS

Volume 21 August 15, 1942 Number 8

CERAMIC ABSTRACTS

Abrasives 161
Art and Archeology 162
Cements 164
Enamel 165
Glass 165
Structural Clay Products 169
Refractories 170
Terra Cotta 172
Whiteware 172
Equipment and Apparatus 174
Kilns, Furnaces, Fuels, and Combustion 175
Geology 176
Chemistry and Physics 178
General 179

THE BULLETIN

Ceramic History

Isaac Watts Knowles
By Lucille T. Cox 151–57

War Emergency

Glass Goes to War
By T. J. Thompson 161–62

Porcelain Enamel in War Work
By Charles S. Pearce 162–64

After Victory—What?
By Bennett Chapple 164–65

Dowled Masonry
By Frederick Heath, Jr. 165–66

Editorial

A Study of Ceramic Materials in the Mining Schools of the United States
By A. F. Greaves-Walker 167

Art Paper

Functional Design
By C. M. Harder 174–76

Advertisers' Index 6

Buyers' Guide 12, 16, 20, 21

Roster of Paid Corporation Members 177–178

INDEX TO ACTIVITIES

American Ceramic Society, Forty-Fourth Annual Meeting financial report, p. 172.
members in service, resolution, p. 170.

Biggers, J. D., Libbey-Owens-Ford Glass Co. president, biog., photo., pp. 157–58.

Ceramic Educational Council, minutes of annual meeting, p. 170.
Cress, W. C., joins Armour Research Foundation staff, p. 173.

Divisions, Enamel, Moore, D. G., Secretary, photo, p. 171.
Refractories, Autumn Meeting information, p. 170.
Structural Clay Products, Theobald, E. F., Secretary, photo, p. 171.
White Wares, Beam, J. R., Secretary, photo, p. 171.

Illinois Mineral Industries Conference, cancellation, p. 173.

Lawson, C. H., Waltham Chamber of Commerce citation, p. 171.
Local Sections, Michigan-Northwestern Ohio, May meeting, p. 170.

Members, membership workers' record, p. 169.
new, for July, p. 169.
paid membership record, p. 168.
roster changes for July, p. 169.

National Academy of Sciences, War Metallurgy Committee, purpose and membership, chart, pp. 159–60.

Photographs, Beam, J. R., p. 171.
Biggers, J. D., p. 158.
Moore, D. G., p. 171.
Ritter, E. W., p. 173.
Theobald, E. F., p. 171.
War Metallurgy Committee, chart, p. 159.
Williams, C. E., p. 159.

Ritter, E. W., assistant to president, Corning Glass Works, biog., photo, p. 173.

Treasury of Science, new publication, p. 172.

War Emergency, civilian war service, Civil Service position open, pp. 160–61.
national emergency steels published symposium, p. 172.
structural clay products off restricted list, p. 161.
War Metallurgy Committee, purpose and membership, chart, pp. 159–60.
Williams, C. E., chairman, War Metallurgy Committee, biog., photo, pp. 158–59.

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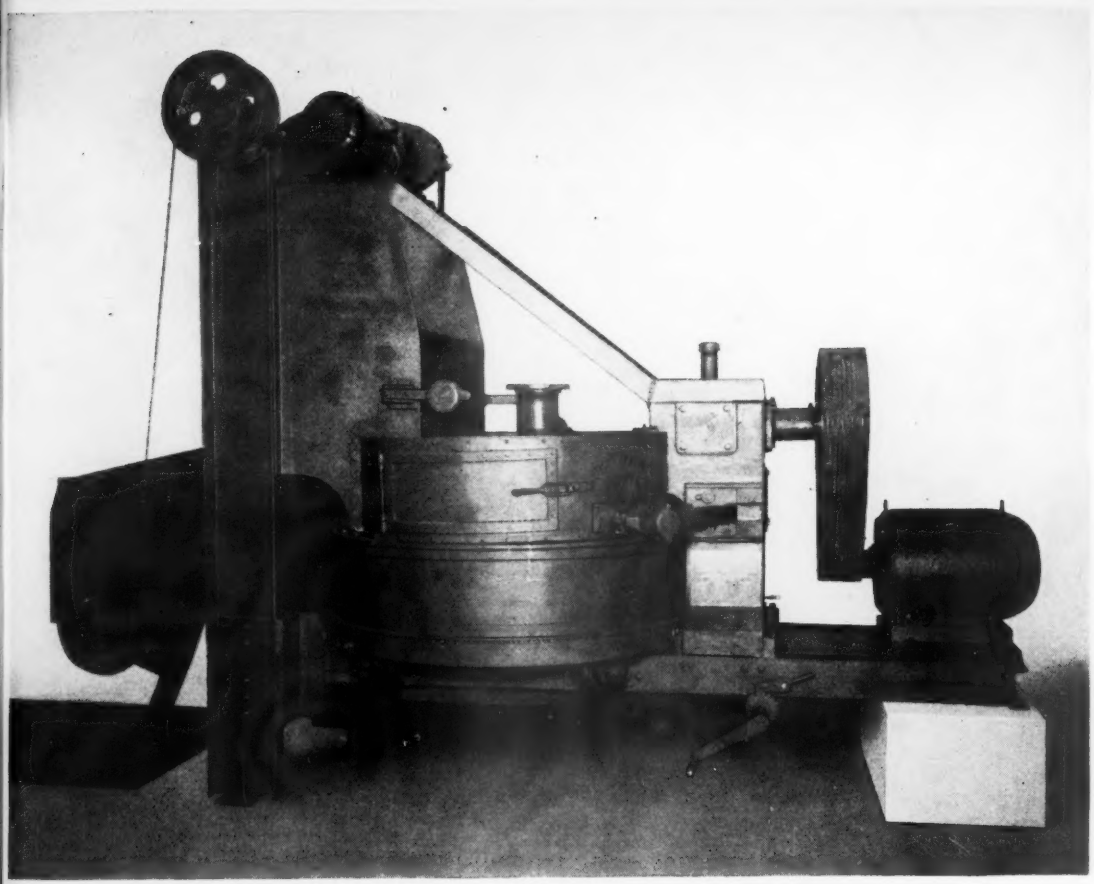

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REFRACTORIES

ALPHABETICAL LIST OF ADVERTISERS

	Page
American Potash & Chemical Corporation	8
American Rolling Mill Co.	7
American Telephone & Telegraph Co.	24
Buyers' Guide	12, 16, 20, 21
Carborundum Co.	13
Classified Ad.	17
Corhart Refractories Company, Inc.	10
Drakenfeld, B. F. & Co., Inc.	Inside Front Cover
Du Pont de Nemours, E. I., & Co., Inc.	22
Edward Orton, Jr., Ceramic Found.	14
Frazier-Simplex, Inc.	11
Hammill & Gillespie, Inc.	17
Hommel, O., Company	17
Industrial Ceramic Products, Inc.	18
International Pulp Co.	18
Lancaster Iron Works, Inc.	2–3
Louthan Mfg. Co.	18
Maxson, Elwyn L.	15
McDanel Refractory Porcelain Company	8
Metakloth Co.	8
Metal & Thermit Corporation	Outside Back Cover
Montgomery Porcelain Products Co.	6
National Engineering Co.	19
Norton Co.	4–5
Orton, Edward Jr., Ceramic Found.	14
Pacific Coast Borax Company	23
Paper Makers Importing Company, Inc.	15
Pennsylvania Salt Mfg. Co.	9
Porcelain Enamel & Mfg. Company	8
Potters Supply Company	23
Proctor & Schwartz, Inc.	8
Professional Directory	18
Solvay Sales Corporation	17
Spinks, H. C., Clay Company	Inside Back Cover
Stauffer Chemical Co.	*173
Swindell-Dressler Corp.	18
United Clay Mines Corp.	17
Vitro Mfg. Company	6
Wilson, H. W., Company	23

* In Editorial Section.

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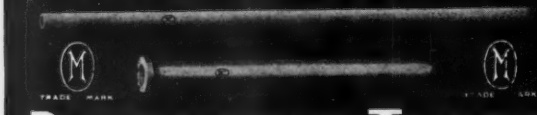

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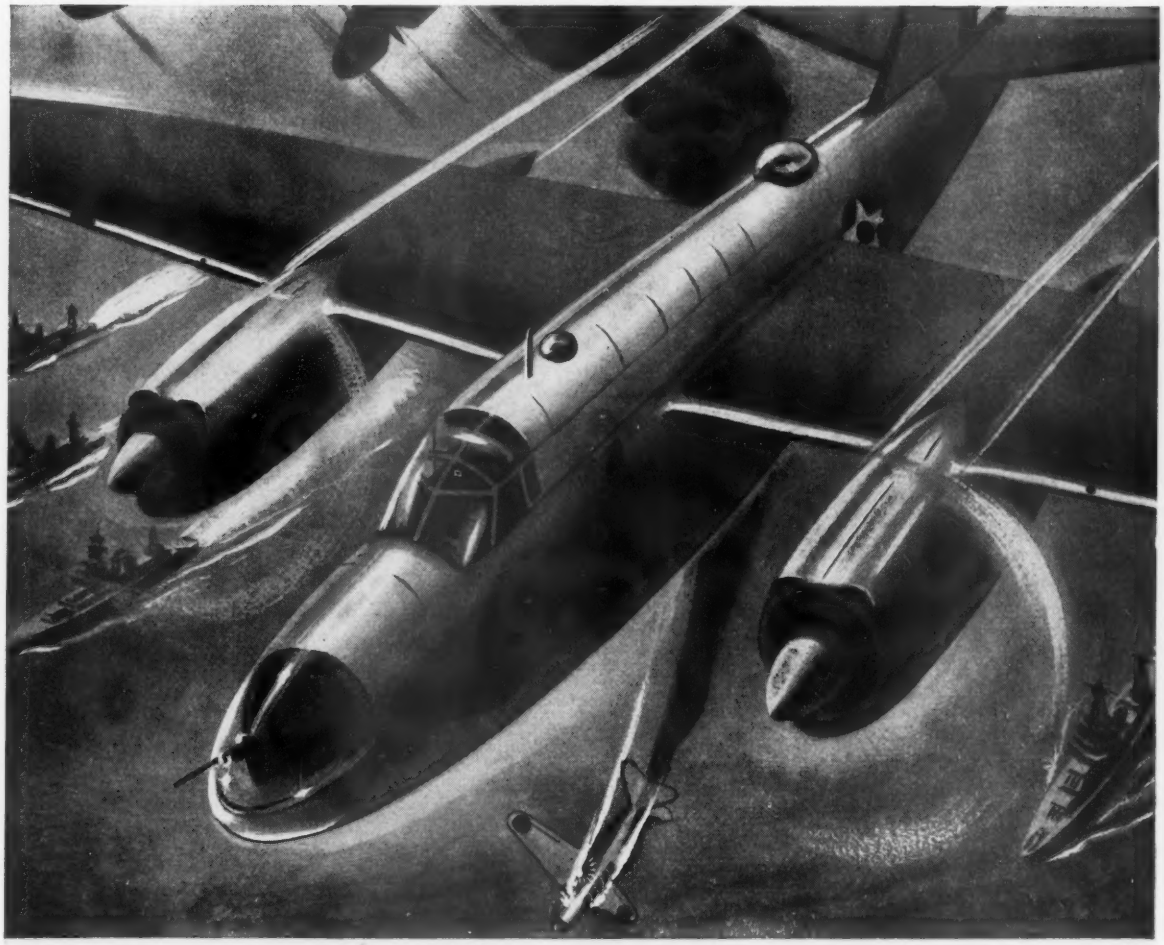

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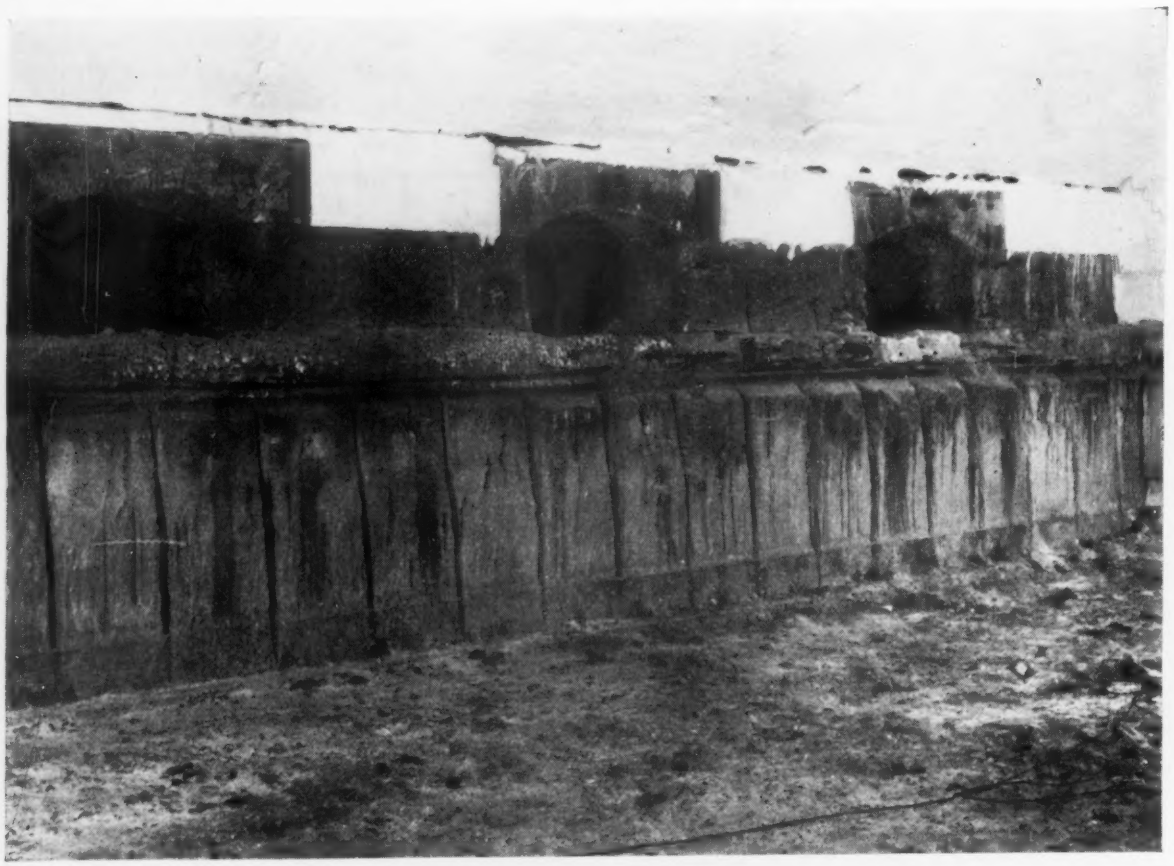

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Compiled by

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JOURNAL REFERENCE: The journal name appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 21 **August 15, 1942** **No. 8**

Abrasives

Machine tool construction in carbide tool grinder. ANON. *Can. Machinery*, **53** [4] 108 (1942).—A new carbide tool grinder which uses 6-in. carbide or diamond wheels has been placed on the market by the Hammond Machinery Builders. E.D.M.

Portman rotary surface grinder. ANON. *Machinery* [N. Y.], **48** [10] 173 (1942).—A new rotary-type surface grinder capable of grinding concave, convex, and flat surfaces is described. R.H.B.

Radiac abrasive cut-off machine. ANON. *Machinery* [N. Y.], **48** [10] 174 (1942).—An abrasive wet cut-off machine with a patented hand-operated vise is shown. See *Ceram. Abs.*, **20** [6] 135 (1941). R.H.B.

Sav-Way internal grinder. ANON. *Machinery* [N. Y.], **48** [10] 176 (1942).—This grinder is capable of grinding holes up to 9 in. deep and $^1/_4$ to 18 in. in diameter with straight or tapered sides. R.H.B.

Tool grinding: Introduction. A. J. SCHROEDER. *Metallurgia*, **26** [151] 13 (May, 1942).—S. emphasizes the importance of keeping tools in the best condition to meet modern precision requirements. Tools should be ground only by men specially trained and having wide experience in the use of modern equipment. E.P.

BOOK

Surface Finish: Report of the Research Dept., Institution of Production Engineers. G. SCHLESINGER. Inst. Production Engrs., London, 1942. 231 pp. Reviewed in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 155, p. 146 (May, 1942).—S. presents the results of investigations on the surface finish of numerous products (mainly ferrous, with a few nonferrous) by various instruments (Profilometer, Surface meter, Profile microscope, Comparascope, comparison microscope, and Vickers microscope). The following subjects are dealt with: principal factors involved, influence of the scratching action of the stylus of tracer instruments, classification of surfaces without measurement, quantitative photomicrography, dimensions and surface roughness of gauges, instruments used, and investigation of surface roughness in the U. S. [NOTE: An omission from among the methods of evaluating surface finish is the reflectivity method developed by L. Kenworthy and J. M. Waldram, working for the British Non-Ferrous Metals Research Assn.]. See *Ceram. Abs.*, **19** [10] 227 (1940).

PATENTS

Abrading device. G. W. ROSS. U. S. 2,285,874, June 9, 1942 (May 22, 1941).

Abrading machine. H. N. BARNES. Brit. 545,257, May 28, 1942 (Nov. 12, 1940). L. K. GODDU (American Optical Co.). U. S. 2,286,361, June 16, 1942 (March 27, 1939).

Automatic honing mechanism and control means therefor. C. W. FLOSS. U. S. 22,125, June 23, 1942 (Aug. 19, 1940); reissue of U. S. 2,164,811, July 4, 1939 (Feb. 15, 1938).

Coating mechanism for wheels. N. P. DI CESARE. U. S. 2,285,695, June 9, 1942 (April 11, 1941).

Cutting and grinding tools. WALTHER DAWIHL (General Electric Co.). U. S. 2,285,909, June 9, 1942 (June 8, 1940).—A tool consisting of diamonds and a metallic binder characterized by the fact that the metallic binder consists of a chemical compound of cobalt, tungsten, and carbon in accordance with the formula Co_3W_3C.

Devices for sharpening or honing safety-razor blades. J. R. CLAYTON. Brit. 545,095, May 20, 1942 (Feb. 26, 1941).

Granular-coated article and its manufacture. H. P. KIRCHNER (Carborundum Co.). U. S. 2,286,208, June 16, 1942 (Dec. 3, 1940).

Grinding machine. A. W. MALL. U. S. 2,286,293, June 16, 1942 (March 4, 1940).

Grinding-wheel dresser. J. H. NELSON (Dumore Co.). U. S. 2,287,701, June 23, 1942 (March 28, 1940).

Grinding-wheel mounting and control. M. H. ARMS AND J. B. JOHNSON (Bryant Chucking Grinder Co.). U. S. 2,288,508, June 30, 1942 (April 23, 1940).

Honing machine. H. J. CALDWELL (Barnes Drill Co.). U. S. 2,287,085, June 23, 1942 (Sept. 29, 1939).

Lapping machine truing apparatus. H. S. INDGE (Norton Co.). U. S. 2,285,717, June 9, 1942 (March 16, 1940).

Machine for grinding facets in lens edges. A. L. ANDERSON (Cosmet Corp.). U. S. 2,286,886, June 16, 1942 (Feb. 29, 1940).

Means for trimming shaped grinding wheels. A. C. WICKMAN. U. S. 2,286,046, June 9, 1942 (Oct. 15, 1940).

Method and means for forming or dressing grinding wheels used for form grinding. S. J. HARLEY AND J. E. WAINWRIGHT. U. S. 2,286,409, June 16, 1942 (Oct. 2, 1939).

Producing abrasive metal carbides. R. R. RIDGWAY (Norton Co.). U. S. 2,285,837, June 9, 1942 (Nov. 23, 1940).

Stone-polishing machine. W. G. CUMMING (Granite City Tool Co.). U. S. 2,285,808, June 9, 1942 (Dec. 12, 1940).

Valve-seat grinder. H. G. MILLER. U. S. 2,287,697, June 23, 1942 (Feb. 7, 1941).

Art and Archeology

Buckingham luster. H. M. WOODRUFF. *Bull. Art Inst. Chicago*, **35**, 94–96 (Nov., 1941).—The Lucy Maude Buckingham Collection of English luster at the Chicago Art Institute has been reinstalled in larger quarters, restudied, and recatalogued. The majority of the pieces are in perfect condition. Most English luster was made in the 19th century, the best before 1830, and it was continuously reproduced up to 1875. The dated pieces in the collection are all after 1800. Silver luster has long been considered the first of the English metallic luster glazes; it was applied to a dark clay body, and the resulting ware has a gleaming depth closely simulating costly sterling or plated ware. Casual observers have sometimes mistaken these luster pieces for silver metal. 6 illustrations. K.R.

Budding porcelain collector. B. GARDNER. *Apollo*, **34**, 133 (1941); *Trans. Brit. Ceram. Soc.*, **41** [1] 8A (1942).—A short discussion on early transfer printing, gilding, and marks is given.

Chelsea scent bottles and seals. B. GARDNER. *Connoisseur*, **108**, 148 (1941); *Trans. Brit. Ceram. Soc.*, **41** [2] 23A (1942).—An illustrated account of the 18th century Chelsea "porcelain toys" is given. The decoration consisted principally of subjects painted in enamel on a white ground. The modeling was probably executed by craftsmen from Tournai or Vincennes. The scent bottles are about $3^1/_4$ in. high, and the seals about 1 in.

China trade and its influence on works of art. M. JOURDAIN. *Apollo*, **34**, 109 (1941); *Trans. Brit. Ceram. Soc.*, **41** [1] 8A (1942).—Chinese influence on English decoration and applied arts during the late Stuart, mid-Georgian, and Regency periods is briefly discussed. Porcelain, one of the earliest imports from China, was in great demand during the 18th century. Its excellence proved a challenge to European potters, and fine ware shortly appeared from Worcester, Chelsea, Sèvres, and Meissen. An example of Chelsea porcelain (circa 1755) is illustrated.

Color, its measurement, discrimination, and specification. J. W. PERRY. *Proc. Phys. Soc.* [London], **53**, 272–87 (1941).—The principles of color specifications and measurements are analyzed and considered from the viewpoint of color tolerances. Color tolerances are considered under three main headings: (*a*) liminal, on the basis of the rectangular uniform chromaticity system; (*b*) technical, in terms of the phenomena possibly involved; and (*c*) economic. Color tolerances for subtractive mixtures are analyzed for practical application. A uniform chromaticity scale of saturation may consist either of graphs which present, directly superimposed, the hue and saturation scales and a chromaticity scale or of tables made for certain standard diluent radiations. The first method has been worked out in detail for white C as diluent by Hardy (Handbook of Colorimetry, Technology Press, Cambridge, 1936). L.E.T.

Corinthian jar with inscriptions. MARJORIE J. MILNE. *Bull. Metropolitan Mus. Art*, **37** [2] 36–37 (1942).—A little jar with handles in the form of women's heads was acquired by the Museum in 1874. Although part of the Cesnola collection, it comes from Corinth and not from Cyprus and belongs to a class made in Corinth for 150 years beginning with the late 7th century B.C. This specimen is dated about 550 B.C. because of the style of the heads and is of the type found in women's graves. The names of women are neatly scratched under the heads, but they are not portraits as the names are different and the heads are identical. It seems probable that the women were Nereids or perhaps courtesans. Illustrated. A.A.A.

Craft potters of North Carolina: Busbee, Hilton, and Stephen. Influence of Oscar Louis Bachelder. ANON. *Bull. Amer. Ceram. Soc.*, **21** [6] 79–87 (1942).—12 photos.

Design and production of dinnerware for nursery schools. PAUL G. HEROLD AND STUART DODS. *Bull. Amer. Ceram. Soc.*, **21** [6] 113–14 (1942).—3 figures.

Egyptian funerary model of a helmet. LUDLOW BULL. *Bull. Metropolitan Mus. Art*, **37** [2] 41–42 (1942).—The Egyptian Department of the Museum has recently acquired a full-sized funerary model of a helmet; it is made of faience, possibly to imitate a leather or bronze original. As no actual Egyptian helmet of any material has survived, it is difficult to tell what kind of material was used for them. This model was first written about in Egyptian Ceramic Art, by Henry Wallis, London, 1898, and it remains unique as far as is known. It is believed that the helmet was found on the head of a mummy. A.A.A.

English pottery for the American collector. H. B. LANCASTER. *Connoisseur*, **108**, 112 (1941); *Trans. Brit. Ceram. Soc.*, **41** [2] 23A (1942).—Ware made in North Staffordshire and at Liverpool for export to America after the War of Independence is described with illustrations. Many of the examples thought to be from the Herculaneum Pottery, Liverpool, were actually made by Wedgwood, being sent to Liverpool only for transfer printing; the true Liverpool ware is grayer and colder than Wedgwood's creamware. The 18th century Astbury figures, the mottled glazes of Whieldon, and the translucent pieces made by Ralph Wood are mentioned.

Gallatin collection of Greek vases. G. M. A. RICHTER. *Bull. Metropolitan Mus. Art*, **37** [3] 51–59 (1942).—The Museum has acquired the Gallatin collection of Greek vases ranging in date from the 7th to the 3d century B.C. Many of these 250 pieces are of first-rate quality and will raise the standard of the present collections of the Museum. Some of them are interesting in technique, subject, or inscription and will make very fine study material for everyone interested in the life of ancient Greece. Illustrations of outstanding examples depict (1) a man attacking a boar, from the inside of a kylix by the Penthesileia painter (about 460 B.C.); (2) an amphora with a scene showing Ajax attacking Cassandra (about 560 to 550 B.C.); (3) an amphora by the Gallatin painter showing Theseus and Skiron (about 490 to 480 B.C.); (4) Artemis, from a lekythos by the Providence painter (about 480 B.C.); (5) a maenad with thyrsos and snake, from a lekythos by Hermonax (about 460 B.C.); (6) a hydria attributed to the Niobid painter (about 460 to 450 B.C.), the scene showing Triptolemos with Demeter and Persephone; and (7 and 8) scenes from two small lekythoi by the Sappho painter: above, Helios rising from the Sea, Night and Dawn disappearing, and Herakles roasting meat over a burning altar; below, Herakles in Olympus being presented to Zeus by Athena. A.A.A.

I-Hsing pottery. W. ODELL. *Bull. Art Inst. Chicago*, **35**, 36–38 (March, 1941).—Some excellent examples of I-Hsing pottery have been secured by the Chicago Art Institute. Chinese sources provide much information about this pottery. The first potter was active from 1506 to 1521, and his successors have been operating continuously ever since. They are most famous for teaware. The body of the ware is usually a very hard stoneware; it ranges in color from buff to black-brown and also has many shades of red, black, and liver and others called "pear-peel" and "pine-tree flower." The ware is generally left unglazed, the pieces often possessing natural glaze or acquiring the patina of use. This ware strongly influenced the pottery of Europe. Exported with tea during the latter part of the

17th century, the red teapots were so successfully copied by Dutch and English potters that they could hardly be distinguished from Chinese originals. As tea drinking is an art with the Chinese, they had definite criteria for a fine pot. The clay must be of a special kind, and the pot must be small and shallow, with the lid fitting properly to preserve flavor and fragrance; the spout must be straight, as too many curves cause the tea leaves to stick, irritating the tea drinker and defeating the whole purpose of drinking tea, "which is to be at leisure and relaxed." Every person should have his own teapot. K.R.

Old glass for export. C. DAVIS. *Connoisseur*, **108,** 108 (1941); *Trans. Brit. Ceram. Soc.*, **41** [2] 22A (1942).—Waterford glass is discussed, and it is emphasized that not all old glass which is of a steel-blue color is necessarily Irish. Faulty mixing and an insufficient manganese content sometimes resulted in a greenish color. The development of cut glass in England during the 18th and early 19th centuries is briefly sketched.

Old Thuringian porcelain and glass. CHARLOTTE STEINBRUCKER. *Sprechsaal*, **73** [50] 464–65 (1940).—In the 18th century, Macheleid in Sitzendorf and Greiner in Limbach were instrumental in starting 12 Thuringian porcelain factories. Greiner's sons were also porcelain makers, and others of the Greiner family were engaged in glassmaking as early as 1525. A glass factory was founded at Lauscha near Coburg in 1597. Glasses with enamel decorations were made in Lauscha in the 17th and 18th centuries. Kunckel was a very skillful glass cutter of this period. W.H.H.

Overglaze painting in the whiteware industry. WILLY WEHLE. *Keram. Rundschau*, **45** [51] 591–92 (1937).—Different techniques for applying overglaze decoration are described. M.V.C.

Persian jar. HANNAH E. MCALLISTER. *Bull. Metropolitan Mus. Art*, **37** [3] 74–75 (1942).—A Persian pottery storage jar with a turquoise-blue glaze has recently been bought by the Museum. This jar belongs to a group of seven similar jars in other collections, which, because of their size, handsome decoration, and magnificent technique, were thought to have been made only for the very wealthy. All seven of these jars are turquoise blue, have similar proportions, are divided into four main areas by double or single round molding, and share elements of decoration, some of which suggest the patterns of both the book binder and the metal worker. Below the fret pattern on the rim of the jar in small Kufic letters is the inscription "Happiness, peace, nobility, power, and long life to the owner." A.A.A.

Porcelain artists. W. H. TAPP. *Apollo*, **34,** 119, 154 (1941); *Trans. Brit. Ceram. Soc.*, **41** [1] 8A (1942).—A hitherto unrecorded 18th-century book of engravings is described. Its chief interest to the ceramic artist lies in the 300 engravings and drawings by O'Neale. His animal fables on Worcester and Chelsea porcelain are illustrated.

Pottery of the Liverpool museum: some of the rarer specimens. H. B. LANCASTER. *Connoisseur*, **108,** 188 (1941); *Trans. Brit. Ceram. Soc.*, **41** [2] 23A (1942).—L. describes some of the pieces of the Joseph Mayer collection. Illustrations show examples of the work of Barnes, Pennington, and Chaffers.

Ross Coffin Purdy: ceramic leader. ANON. *Bull. Amer. Ceram. Soc.*, **21** [6] 87–91 (1942).—2 photos.

Ravenscroft jugs. E. B. HAYNES. *Connoisseur*, **108,** 175 (1941); *Trans. Brit. Ceram. Soc.*, **41** [2] 22A (1942).—Ravenscroft (17th century) glass decanters and pitchers are illustrated and described. With one exception, these are of lead glass and have a crizzled surface. H. suggests that there may be a relationship between crizzling and the thickness of the glass. A very early example (before 1674) is of heavy soda glass; it is badly corroded.

Rio Grande glaze paint ware. ANNA O. SHEPARD. Preprinted from *Carnegie Inst. Washington Pub.*, No. 528, pp. 129–262 (March, 1942).—The place of ceramic technological analysis in archeological research is illustrated. The Rio Grande glaze paint ware period (A.D. 1350 to 1700) is covered. S. discusses previous studies of this ware in the archeological classification of glaze paint types and shows how the present technological approach, aided by advanced methods of microanalysis, petrographic analysis, and statistics, as well as the study of stratification, style, and decoration, has changed some of the previous conceptions of the history of the Indian culture before and after the Spanish influence. The comparison of the results of the petrographic analysis of the tempers of pottery from Albuquerque, Galisteo, Pecos, Salines, and various other sites in this large river area with the geological sources and natural outcrop of these same mineral tempers shows some interesting new ideas concerning trade among these early tribes, both in the pottery itself and in the raw materials used in its fabrication. In the course of this study many questions have appeared to form the basis for much future study along these lines. These questions are listed. The increasing exactness of microchemical analysis as used on the minute samples of glaze scratched from the surfaces of the ware with a diamond tool sheds new light on glaze and firing techniques of the potters in these different periods. The technological aid to archeological research, however, is limited at present by the methods of sampling prevalent in the past which are apt to give a disproportionate view of the situation unless allowance is made for standard error of proportions. Specific and comprehensive notes on statistical methods, petrographic analyses, an outline of a method of microchemical analysis, and spectrographic analyses used in these studies are given in appendices. 27 figures, including maps, charts, and photomicrographs of thin sections of tempers. M.E.P.

Saxon ceramic industry and deposits of raw materials. HANS LEHMANN. *Sprechsaal*, **73** [49] 445–48 (1940).—Progress in ceramics depends upon the discovery of suitable raw materials. When clay and kaolin which fired pure white were available, the majolica industry arose as a predecessor to the whiteware industry. English whiteware increasingly appeared on the market and displaced majolica. The continental blockade changed the picture, and from that time on, the Saxon whiteware industry was developed on the foundation of domestic raw materials. The porcelain industry originated in Saxony but is less widespread there than in other regions. W.H.H.

Technical aspect of color tolerance. H. W. ELLIS. *Proc. Phys. Soc.* [London], **53,** 288 (1941).—E. discusses the extent to which the characteristics of dyed material are governed by the technical limitations of dyestuffs and the various factors that must be considered in the selection of dyes to produce a given result. The terms "shade," i.e., hue of a color, and "strength," i.e., depth of color, as employed by the dyestuff-using industry are defined, and the methods by which these two factors are measured and controlled in the commercial production of dyed materials are described. In dyeing a material, the following three variables must be considered: (1) selection of dye and degree of fastness, (2) shade of pattern, i.e., nature and extent of the shading color, and (3) amount of color to give the correct strength. L.E.T.

PATENTS

Decalcomania papers. MCLAURIN-JONES CO. Brit. 544,942, May 20, 1942 (Aug. 10, 1939).

Designs for:

Ash tray. C. W. SAWYER (Libbey Glass Co.). U. S. 132,867, June 23, 1942 (Sept. 25, 1941).

Candlestick holder. C. W. SAWYER (Libbey Glass Co.). U. S. 132,868, June 23, 1942 (Sept. 25, 1941).

Pitcher. C. W. SAWYER (Libbey Glass Co.). U. S. 132,677, June 9, 1942 (Sept. 25, 1941).

Plate. WILLIAM BRUNING (Mayer China Co.). U. S. 132,760, June 16, 1942 (April 18, 1942).

Vase. C. W. SAWYER (Libbey Glass Co.). U. S. 132,691 and 132,692, June 9, 1942 (Sept. 25, 1941).

Cements

Effect of admixtures on Portland cement. CHARLES H. JUMPER AND GEORGE KALOUSEK. *Rock Products*, **45** [4] 54–55, 57; [5] 28, 29 (1942).—The authors discuss the effects on changes of temperature with time and on time of set of calcium acetate, calcium chloride, calcium iodide, calcium nitrate, plaster of Paris, plaster of Paris and tannic acid, sodium nitrate, sodium sulfate, potassium sulfate, ammonium chloride, and ammonium chloride and iron when mixed with cement clinker and water. The addition of aqueous solutions of aluminum salts to cement clinker accelerated the reactions as manifested by the evolution of heat; aluminum chloride, aluminum sulfate, and potassium aluminum sulfate were used. The influence of the salts was governed markedly by the type of clinker used. B.C.R.

Mechanism of cement formation in the rotary kiln: VI, Specific gravity and specific weight of raw mix in the rotary cement kiln. T. YOSHII. *Jour. Soc. Chem. Ind. Japan*, **43** [8] 250–52B (1940) (in English).—The specific gravity of the raw mix in both dry- and wet-process kilns increases gradually with calcination, but the finished clinker does not always show the highest value; an immature clinker containing free lime may show the highest value. The specific gravity of the celite part was calculated from the clinker constituents and the specific gravity of clinker minerals. It lies between 3.19 and 3.41 and increases with calcination. The specific weight of the raw mix in both the wet and the dry process was measured under actual kiln conditions and when pulverized so as to leave 6% residue on a 4900-mesh sieve. The specific weight of the raw mix in the wet kiln is greater than that of the raw mix in the dry kiln; this may be attributed to greater compacting of particles of the mix in the wet kiln. **VII, Change in appearance and specific heat of raw mix in the rotary kiln.** *Ibid.*, pp. 252–55B.—Color changes of the raw mix in the dry- and wet-process kilns were observed in two ways: under kiln conditions and when pulverized. The changes of color are more sudden in the wet kiln; the color passes through greenish white, light red, yellowish white, cream yellow, and greenish yellow to the final cement color. Specific heats at 20° to 100°C. were measured by the mixing method. The results are as follows:

Material	Process	Specific heat
Limestone		0.203
Clay	Dry	0.205
Clay	Wet	0.207
Raw mix	Dry	0.203
Raw mix	Wet	0.204
Clinker	Dry	0.184
Clinker	Wet	0.185

These results show that the specific heat of the raw mix decreases gradually in the calcining zone and then drops suddenly with the progress of firing. The specific heat of the celite part calculated with the aid of the microscope was 0.213 to 0.184 for the dry-kiln clinker and 0.207 to 0.193 for the wet-kiln clinker. These results show that, with a given chemical composition of the batch, the real constituents of the celite part change with the process of calcining. This change agrees with the change in specific gravity. A comparison of the various physical changes in the dry and the wet kilns shows why the cement clinker is more rapidly calcined in the wet kiln than in the dry kiln. **VIII, Chemical changes taking place in the rotary cement kiln.** *Ibid.*, [9] 280–83B.—The CaO content of raw mix decreases gradually with the progress of calcination, but the amount of SiO_2, Al_2O_3, MgO, and especially Fe_2O_3 increases. Fe_2O_3 and MgO affect the cement color markedly. They are abundant in the coal ash, and as Fe_2O_3 is very heavy, it is apt to settle at the boundary of the calcining and clinkering zones, in both wet and dry processes. The quantity of dust escaping from the kiln seems to be greater in the wet process than in the dry process, and the effect of the coal ash on chemical composition of the raw mix is therefore more remarkable in the wet than in the dry process. A comparison of the calcining mechanisms in the two processes, disregarding the drying, dehydrating, and preheating zones, shows that the clinker is more rapidly and completely calcined in the wet than in the dry kiln. This is attributed to the compact structure of the raw cake in the wet process and the sudden development of exothermic reaction which is suppressed in the drying and dehydrating zones in the rear of the kiln. Mol ratios of CaO/SiO_2 do not always increase proportionally with the progress of burning. The ratio increases to the vicinity of the calcining zone, then falls, and then increases with the starting clinker. This signifies that limestone and clay substances are not ready to react simultaneously everywhere, but react alternately by mutual diffusion in solid phase after their gradual decomposition. **IX, Mechanism of cement formation and changing composition of the celite in the rotary kiln.** *Ibid.*, p. 283B.—The celite in the clinker for the dry and wet processes is composed as follows:

	CaO		Al_2O_3		Fe_2O_3	
	Dry	Wet	Dry	Wet	Dry	Wet
Weight %	3.91	3.97	1.98	2.36	2.78	2.73
Mol ratio	4.01	4.19	1.11	1.35		

For the dry process, $2.01CaO \cdot 1.11Al_2O_3$ corresponds to $5.36CaO \cdot 3Al_2O_3$. For the wet process, $2.19CaO \cdot 1.35Al_2O_3$ corresponds to $4.87CaO \cdot 3Al_2O_3$. This shows that the celite can probably be considered a solid solution. The mechanism of cement formation can be summarized as follows: Belite is formed at first, and then the celite develops. After a short time, alite is formed; it contains considerable calcium aluminate in the early stages of its formation. During calcination most of the calcium aluminate decomposes to CaO and $5CaO \cdot 3Al_2O_3$. CaO is then combined with belite, forming alite, and $5CaO \cdot 3Al_2O_3$ is believed to be absorbed in the celite. This is a reason why $3CaO \cdot Al_2O_3$ cannot be detected under the microscope. The celite, in the early stage of its formation, is a poor aluminous calcium ferrite, but, as firing progresses, it gradually becomes highly aluminous and finally becomes a solid solution of calcium aluminoferrite which approaches brownmillerite in composition. It contains a little less Fe_2O_3 and a little more Al_2O_3, however, than brownmillerite. For Parts **I–V**, see *Ceram. Abs.*, **20** [1] 5–6 (1941). W.H.H.

Removing alkalis by heating with admixtures. HUBERT WOODS. *Rock Products*, **45** [2] 66–68 (1942).—W. studied the effect of additions of sodium and calcium salts to raw cement clinker on the volatilization of sodium and potassium. Calcium sulfate retarded the volatilization of sodium and potassium, calcium fluoride had no material effect, sodium chloride aided the volatilization of potassium but increased the sodium content of the clinker, and calcium chloride had more effect on potassium than on sodium. In plant practice, the volatilization of potassium is always proportionately greater than that of sodium; the average volatilization is greater with the dry process than with the wet process. B.C.R.

PATENTS

Cement and cement manufacture. C. H. BREERWOOD (Valley Forge Cement Co.). U. S. 2,288,179, June 30, 1942 (April 16, 1940).

Manufacturing Portland cement. C. R. JACKSON (Oliver United Filters, Inc.). U. S. 2,286,420, June 16, 1942 (June 19, 1939).—The method of dewatering hydraulic cement-making materials preparatory to calcining them comprising filtering the materials in the presence of a small quantity of finished cement, not in excess of 1% calculated on a dry-weight basis.

Enamel

Automatic enameling furnace designed for controlled oxidation firing. W. G. MARTIN. *Proc. Porcelain Enamel Inst. Forum, Sixth Forum, Oct., 1941,* pp. 96–106.—In the controlled oxidation process, the ground-coated ware is heated up to 1000° to 1100°F. in air so that the oxygen may penetrate the dry bisque and oxidize the surface of the iron base. The ware is then heated to proper fusion in a non-oxidizing atmosphere. This process (1) retards the formation of copperheads, (2) allows control of the degree of oxidation, (3) retards the tendency to fish-scale, and (4) retards the formation of scale on enamel-free areas at high temperature. The special type of enameling furnace and its operation are described. 5 illustrations. See "Controlled . . . ," *Ceram. Abs.*, **21** [6] 119 (1942). L.E.T.

Clays and their application to modern enameling practice. R. L. FELLOWS. *Proc. Porcelain Enamel Inst. Forum, Sixth Forum, Oct., 1941,* pp. 106–10.—It was formerly thought that the primary function of clays was to suspend enamel particles, but recent research has established the fact that clays impart other important properties to enamel. A good enameling clay must (1) have the ability to fire to a white color, (2) impart good opacity to an opaque enamel, (3) have no harmful effect on the gloss or surface texture, (4) promote no scumming, and (5) reduce the tendency of the ground coat to fish-scale. Enameling clays are known as "high" and "low" set clays; their properties are discussed. L.E.T.

Controlling cost in enameling plant. FRED DOERING. *Proc. Porcelain Enamel Inst. Forum, Sixth Forum, Oct., 1941,* pp. 33–40.—For best results in controlling cost in the enameling department, the production department and cost-accounting section must work hand in hand. A series of charts showing the performance of steel enameling are presented together with a weekly summary of shop operations, production per man-hr., weekly respray and scrap reports, etc. The preparation of these reports is discussed. See *Ceram. Abs.*, **21** [2] 36 (1942). L.E.T.

Fish-scaling. W. W. HIGGINS. *Proc. Porcelain Enamel Inst. Forum, Sixth Forum, Oct., 1941,* pp. 71–96; *Ceram. Ind.*, **37** [6] 48–52 (1941).—Some characteristics of fish-scaling observed during a study of this phenomenon are discussed. Fish-scaling is always accompanied by the evolution of gas (85 to 90% hydrogen). The tendency to fish-scale is much greater when both sides of the piece are enameled. There is only one type of fish-scaling; it is the result of gas pressure at the metal-enamel interface. H. describes tests which substantiate the hydrogen theory for fish-scaling as proposed by Zapffe and Sims. The proper enameling clay, low water vapor in the furnace atmosphere, the use of only the "rim and core" portion of rimmed-type steel wherever practical, cold-working of the metal surface, and the use of the oxidation-control method of firing minimize the occurrence of this defect. See *Jour. Amer. Ceram. Soc.*, **24** [12] 383–92 (1941). L.E.T.+H.T.

Magnus metal-washing machine. ANON. *Machinery* [N. Y.], **48** [10] 182 (1942).—The automatic washing machine is applicable in the enamel plant for pickling and washing operations. R.H.B.

Molybdenum in enamels. ANON. *Emailwaren-Ind.*, **18** [1–2] 1–2 (1941).—MoO_3 acts as adhering oxide when smelted with Sb_2O_3. See *Ceram. Abs.*, **20** [10] 232 (1941). M.V.C.

Porcelain enameled cooker inserts. E. E. BRYANT. *Enamelist*, **19** [6] 10–11 (1942).—The curtailment of the use of aluminum has resulted in a change to porcelain enameled cooker inserts in electric ranges. B. discusses shapes for porcelain enameling, enamels for use on cooker inserts, application of porcelain enamel, and the thermal-shock test. L.E.T.

Porcelain enameled hot water heating tanks and range boilers. J. J. CANFIELD AND J. E. SAMS. *Proc. Porcelain Enamel Inst. Forum, Sixth Forum, Oct., 1941,* pp. 26–33; see *Ceram. Abs.*, **21** [2] 37 (1942). L.E.T.

Radiation-type pyrometer applied to enamel processing. W. A. BARROWS. *Proc. Porcelain Enamel Inst. Forum, Sixth Forum, Oct., 1941,* pp. 111–17; see "Porcelain . . . ," *Ceram. Abs.*, **21** [1] 6 (1942). L.E.T.

Reclaim of nickel dip solutions. W. B. FELTER. *Enamelist*, **19** [5] 5 (1942).—F. describes a method by which a dark green nickel sludge, formed soon after a half-day run in the clean nickel tank, is brought into solution by the addition of ammonium sulfate in water solution and sulfuric acid. The sludge is believed to be caused by iron displaced from the ware. By this method, nickel salts are conserved in the dip tank. L.E.T.

Structure of lead-free black cast-iron enamels. ANON. *Keram. Rundschau*, **46** [7] 67–68 (1938).—Black castings are superior to nickel-plated iron in many respects. Examples of stable batches for black cast-iron enamels are given. Careful attention must be paid to the maintenance of proper working conditions. M.V.C.

Warpage test. WILLIAM W. COFFEEN. *Proc. Porcelain Enamel Inst. Forum, Sixth Forum, Oct., 1941,* pp. 40–48.—C. discusses the new Tentative Standard Test for Warpage of Flatware approved and published by the Committee on Standardization of Tests for Products of the Porcelain Enamel Institute. A photograph is given of a specimen in the clamped position, with the T-beam gauge in place for measurements along a diagonal traverse. L.E.T.

SEPARATE PUBLICATION

Bibliography of Enameling. *Joint Committee on Vitreous Enamelling of the Institute of Vitreous Enamellers and the British Cast Iron Research Assn. Special Pub.*, No. 1, 120 pp. (1939). Price 15s. Reviewed in *Jour. Soc. Glass Tech.*, **25** [108] 162A (1941).—With the increase in the use of vitreous enamel as a finish, many papers have been published dealing with the various aspects of the enameling process, both technical and theoretical. The present bibliography covers abstracts of papers published within the last eight or nine years, but some outstanding ones of earlier date are also included. The references are arranged in chronological order in six sections, viz., (1) Production, properties, and treatment of articles for enameling; (2) Enamels: composition, properties, treatment, and testing; (3) Enameling processes; (4) Enameling defects; (5) Enameling equipment; (6) General. The abstracts given vary in length from a few lines to more than a page. An author index and a list of the 52 periodicals abstracted are included.

PATENT

Enameling compositions, etc., and method of making. C. E. EVERY (Titanium Alloy Mfg. Co.). Brit. 545,190, May 28, 1942 (Aug. 13, 1940).

Glass

Aid for glass blowing. ANON. *Laboratory*, **13** [3] 56–58 (1942).—Glass blowers' rollers are a pair of motor-driven rollers which support and slowly rotate cylindrical objects. They are especially useful during preheating or annealing which can be allowed to proceed unattended. Another accessory is a small cylindrical glass ball mill with porcelain balls. W.D.F.

Automatic production of glass tubing and rod on the Danner machine. V. E. SIBILIA. *Jour. Soc. Glass Tech.*, **23,** 292–307T (1939).—S. describes the drawing of glass tubing and rod with the Danner machine. The operating difficulties are given, and procedures for their elimination and methods for controlling the product are described.

Colored glass—blue color: II. BRUNO SCHWEIG. *Glass*, **19** [4] 92, 95–96 (1942).—The presence of boric acid in glasses tends to diminish the color otherwise produced by certain metallic oxides. In the case of cobalt, the addition of halogen salts (NaCl or KCl) is necessary to counter-

act the bleaching effect of the boric acid. Data illustrate the effect of an addition of 3% KCl upon the color of glasses of varying B_2O_3 and Co_2O_3 composition. Batch compositions for glasses containing cobalt and cerium are given. S. discusses the use of a combination of cobalt and selenium to yield a pale purple (mauve) color for coloring shop windows. See *Ceram. Abs.*, **21** [7] 140 (1942). B.C.R.

Deviations from Ohm's law in soda-lime glass. R. J. MAURER. *Jour. Chem. Phys.*, **9** [8] 579–84 (1941).—The conductivity of soda-lime glass has been measured as a function of field strength between 0° and 110°C. The data are compared with a recent theory of electrolytic conductivity of solids. The form of the deviation from Ohm's law is correctly represented by this theory up to field strengths of 7×10^5 volts per cm. Reasonable values for the physical constants result from the measurements. See "Conductivity . . . ," *Ceram. Abs.*, **21** [5] 100 (1942). G.A.K.

Dimensions and operational efficiency of some regenerative cross-flame gas-fired tank furnaces. N. A. NICHOLS AND R. HALLE. *Jour. Soc. Glass Tech.*, **25** [111] 60–66P (1941).—Operational data obtained with nine regenerative cross-flame gas-fired tank furnaces producing colorless glass for containers are given in two extensive tables. These tables are very useful to the glass technologist operating tank furnaces. The total volume of the brickwork in the air checker was calculated from the total weight of the brick by assuming their density to be 118.6 lb. per ft.^{3}. The total surface area of the brickwork in the air regenerator was calculated from the following formula:

$$S = 12V\left[\frac{2c}{d} + \frac{2c\,(1-c)}{b}\right] \text{ sq. ft.,}$$

where S = total surface area of brick, V = volume of the checker (volume of brick plus channels) in cu. ft., c = "filling coefficient" (ratio of brick volume to checker volume, V), d = thickness of checker brick in inches, and b = breadth of checker brick in inches. In all cases, the furnaces were near the end of the first third of their lives so that the Moorshead Formula for calculating furnace performance might be applied. The standard performance is expressed as Ls/Fs, where Ls = standard load, i.e., load occupying 10.76 sq. ft. of melting area per ton of glass melted for 24 hr. Then Ls = Melting End Area/10.76 and Fs (fuel consumption for standard load) = $Fa + 0.15\,[Ls - (1.10 - 0.3n)La]$, where Fa = actual fuel consumption in tons per 24 hr., La = actual load in tons per 24 hr., Ls = standard load in tons per 24 hr., and n = proportion of cullet in the glass produced. R.H.B.

Discussion of "Structure of vitreous silica." H. P. ROOKSBY AND L. A. THOMAS. *Nature*, **149** [3775] 273–74 (1942).—The work of Lu and Chang (*Ceram. Abs.*, **20** [11] 271 (1941)) on the X-ray diffraction pattern of vitreous silica is discussed. From pinhole transmission photographs made over the range 0.5 to 0.05 mm., the authors conclude that the bands at 8.18 and 5.80 obtained by Lu and Chang are spurious. G.A.K.

Effect of heat and humidity on the strength and tension of glass silk and glass yarn: II, Effect of atmospheric humidity and immersion in water. PAUL AUGUST KOCH AND GÜNTHER SATLOW. *Klepzig's Textil-Z.*, **44**, 104–106 (1941); abstracted in *Chem. Zentr.*, **1941, I**, 2161.—When wet, glass fibers and yarn decrease greatly in strength and tension, and glass silk decreases in strength. Relative atmospheric humidity affects the strength and tension only when it is very high (over 80% for glass silk and over 90% for glass yarn). The effect on the strength produced by distilled water and undistilled water is the same. When the material is left lying in water, the strength and tension decrease. The state of the material and its brittleness affect the uniformity of the results. See *Ceram. Abs.*, **20** [6] 141 (1941). M.V.C.

Experimental work on glazes: I and II. JOSEF WOLF. *Sprechsaal*, **73**, 341–43, 349–51, 356–57 (1940); abstracted in *Chem. Zentr.*, **1941, I**, 2013.—Lead oxide produces easily flowing glazes and a bright surface. Barium oxide produces easily fusible and brilliant glazes provided certain firing conditions are maintained; it sometimes causes a characteristic wrinkled, puckered, or rough surface which could serve as trimming in some instances. This phenomenon is not well understood. Strontium oxide also gives easily fusible and easily flowing glazes; these can sometimes be opacified easily. Mat glazes can be made with calcium oxide. The tendency (determined by Seger) of alkali glazes to become milky when boron trioxide and alumina are present was observed in the tests. Opacification can be so complete that the glazes become opaque and resemble porcelain. Magnesium oxide produces difficultly fusible glazes which tend to peel or form drops, and such glazes have been used for ornamentation. When fired at low temperature, magnesia glazes do not fuse smoothly but wrinkle lengthwise and crosswise because of their viscousness. They may be coated with an easily fusible glaze and fired again at a somewhat higher temperature. Zinc oxide gives a glossy glaze if the addition does not exceed 0.3 mol; if more is added, slightly mat or crystallized glazes or, at higher temperatures, crystal glazes are obtained. Experiments showed that usable glazes can be made with little or no lead. Their firing interval lies between Seger cones 03a and 2a; others may be fired to Seger cone 8. Acidification may be raised to about 1.4. The degree of acidification of the different glazes was 1.077, 1.231, and 1.385. In calculating the degree of acidification, the boron trioxide in the Seger formula was added to the R_2O_3 compounds. Most of the glazes are difficultly fusible. M.V.C.

Factory production of special glasses for discharge lamps. P. STATON. *Jour. Soc. Glass Tech.*, **23**, 281–91T (1939).—The compositions of glasses suitable for low-pressure and high-pressure mercury vapor lamps are given, and comments are made on the conditions to be observed in their commercial preparation. Low iron oxide content is essential, especially in the hard glasses for high-pressure lamps, to ensure high transmission of ultraviolet light. Experiments show that in the case of certain borosilicate glasses the addition of 0.5% sodium chloride to the batch resulted in an appreciable reduction in iron oxide content. Experiments are recorded on a series of glasses of stated composition containing cobalt, nickel, copper, or iron oxide or their mixtures designed to transmit ultraviolet light efficiently within certain wave-length limits and as little as possible visible light. The importance of wall thickness of the lamp bulb in this connection is referred to, and the methods adopted for controlling the transmission are described.

Fire-fusing glass colors onto glass blocks. ANON. *Amer. Glass Rev.*, **61** [33] 16 (1942).—The Tempra Glass Products Company of California claims to have originated the idea of fire-fusing glass colors on glass building brick. These colors are applied by spraying and are fired and annealed in a continuous electric lehr with a firing chamber 65 ft. long and a conveyer 160 ft. long. The blocks are then carved with sand, cutting through the film of vitreous color. A.P.

Flexible glass fiber tape improves blood plasma transfusion apparatus. ANON. *Bull. Amer. Ceram. Soc.*, **21** [5] 75 (1942); *Amer. Glass Rev.*, **61** [28] 7 (1942). A.P.

Furnace insulation. G. KÖRRN. *Keram. Rundschau*, **46** [47] 550–51 (1938).—Partial insulation of furnaces for smelting glass gives a 6 to 15% saving in fuel; complete insulation gives 20%. Heating only at certain points is to be avoided. The kind of insulation used must suit conditions; vertical insulation is good. A covering of insulating block may be used, or the joints may be filled with quartz sand. The crown may be insulated by a double arch and air space or with a layer of filler. Insulating materials include Moler earth, kieselguhr, wood ash, regenerator slag, pumice gravel, magnesianite block, Kalorite block, and glass wool. M.V.C.

Glass insulation in the construction of electric machines. B. M. TAREEV, V. A. PRIVESENTSEV, AND N. V. ALEKSANDROV. *Vestnik Elektroprom.*, **10** [12] 23–27 (1939); abstracted in *Physik. Ber.*, **22** [4] 427 (1941).—Glass is used in electrical machinery in the form of thin plates, glass enamels, and glass wool; it is superior to cotton insulation as its heat conductivity is 4 times that of cotton. It is corrosion resistant and has low hygroscopicity. Glass wool made of fused quartz possesses the best qualities. Several Russian products are described. M.H.

Glass manufacture for electric lamps. Development of special glasses for mercury discharge lamps. J. E. STANWORTH. *Jour. Soc. Glass Tech.*, **23**, 268–80T (1939).—Glasses containing 5% boric oxide plus phosphoric oxide, 20 to 35% alumina, and 15% of the basic oxides, lime, baryta, magnesia, and zinc oxide, the remainder being silica, have been studied with a view to finding suitable hard glasses for the inner tubes of high-pressure mercury discharge lamps. Glasses of this type containing more than approximately 27.5% alumina or more than approximately 7.5% lime bubble too much during bench working in an oxy-coal gas flame. If the lime and alumina contents are too low, however, the glasses are difficult to found and work at the furnace. A glass of the theoretical composition SiO_2 56, Al_2O_3 24, CaO 7.5, BaO 7.5, and B_2O_3 5 was melted on a semicommercial scale in a small tank furnace constructed from china clay-ball clay blocks. Satisfactory lamps may be made using bulbs blown from this glass which, in addition to having excellent lumen maintenance, can be run horizontally without magnetic control.

Glass replaces steel. ANON. *Ind. Power & Fuel Economist*, **17** [192] 124 (1941).—Glass can now be used for the tops of hot cabinets of the type used in canteens and restaurants. G.A.K.

Glass silk as insulating material for electricity and heat. M. S. ASLANOVA. *Novosti Tekhniki*, **9** [19] 11–12 (1940); abstracted in *Chem. Zentr.*, **1941, I,** 2161.—The advantages of glass silk over natural silk, cotton, and asbestos for heat and electrical insulation are discussed. Its high mechanical resistance and thermal stability make it suitable for streetcar motors and lifting magnets. See "Glass wool . . . ," *Ceram. Abs.*, **19** [3] 64 (1940). M.V.C.

Glass wool ends noise problem in test cells for airplane engines. ANON. *Eng. News-Record*, **128** [20] 823 (1942).—The following qualifications are necessary for satisfactory sound insulation in testing aircraft engines: a high noise-absorption factor with a relatively high sound-absorption coefficient throughout the audible sound range; high resistance to 100-m.p.h. winds and severe climatic conditions, including repeated thawing and freezing; fireproof material; elimination of the pollution of the air stream with fine particles; a material economical to maintain; and ability to withstand periodical removal of greases and other inflammable materials. Glass wool was used because it met these requirements. G.A.K.

Inorganic fibers. D. WOLOCHOW. *Can. Chem. & Process Industries*, **24** [7] 333–35 (1940).—W. gives a brief historical sketch and reviews the properties and uses of asbestos, mineral wool, and glass fibers. B.L.

Iron-glass seal. ANON. *Product Eng.*, **13** [6] 357 (1942).—A glass having an expansion very close to that of iron has the approximate composition 45 SiO_2, 14 potassium oxide, 6 sodium oxide, 30 lead oxide, and 5% calcium fluoride. To make an airtight seal between lead-bearing glass and iron wire, lead-free glass is first placed directly over the metal, and lead-containing glass is then sealed to the other glass layer. M.H.

Lead arsenate and lead phosphate in opal glasses. H. P. ROOKSBY. *Jour. Soc. Glass Tech.*, **23**, 76–81T (1939).—Evidence is given from X-ray analysis for the conclusion that the opacifying substance in a lead glass containing arsenic is lead arsenate, $Pb_3(AsO_4)_2$, although no direct comparison with a compound of this composition was made. The replacement of arsenic with phosphorus produces an opal glass in which the opacifying substance is lead phosphate, $Pb_3(PO_4)_2$. In this case, the lead phosphate was identified directly. The crystal structures of the lead arsenate in the opal glass and lead phosphate and their relations to the structures of some members of the apatite group of minerals are briefly discussed, dimensions of the unit hexagonal cells being determined. For lead arsenate a_0 = 10.02 a.u., c_0 = 7.37 a.u. The formation of solid solutions between lead phosphate and lead chlorophosphate is described.

Organization and work of Research Enterprises, Ltd. W. E. PHILLIPS. *Engineering Jour.*, **25** [3] 129–35 (1942).—To meet a demand for optical glass for instruments ranging from binoculars to dial sights, Research Enterprises, Ltd., Toronto, Ont., was organized as a government-owned company operating under the Minister of Munitions. Optical glass is a fundamental requirement in the production of fire-control instruments for warfare, which are, for the most part, of the telescopic type. The use of glass in lenses and prisms is based on its properties of reflection and dispersion. The routine measurements of refractive indices of meltings are made with a Pulfrich refractometer, and values of dispersions are accurate to 0.00003. The fundamental task in lens design is to bring together, to the same focus, rays of one or more colors. This can be successful only to the degree that the relative dispersions in the two glasses are similar. By the proper combination of different types of glass of suitable refractive index and dispersion, the effects of dispersion are eliminated, and an image free of color is produced. Glass pots are made of a mixture of three types of china clay and two types of ball clay by slip casting, with sodium silicate and sodium hydroxide as deflocculants. The pot is used only once and is then ground for grog. The furnaces are of the single-pot type and are either regenerative or recuperative. The pots are mostly heated by radiation from the furnace crown, and temperatures must be uniform and subject to close control. Consumption of city gas amounts to 10 million cu. ft. per month. Previous to the melting, the pots are heated to 1100°C. and moved quickly to the melting furnace. The temperature is raised to above 1450°C., and the batch is then introduced. The glass is fined and stirred for about 5 hr. The annealing of optical glass is of the greatest importance. Fine annealing requires the maintenance of temperature within 1° for periods of 24 hr. Optical glass is produced in three standard forms: (1) chunks, as they come broken from the pot, (2) slabs, made from chunks by softening and pressing in a mold and grinding and polishing the edges, (3) moldings or pressings. In grinding and polishing, the tolerances for a flat surface are as small as $^1/_{1,000,000}$ in. See "Canada . . . ," *Ceram. Abs.*, **20** [11] 260 (1941). G.A.K.

Physicochemical researches on the fine structure of glasses: III, Binary and pseudobinary glasses without appreciable packing effect. E. KORDES. *Z. Physik. Chem.*, **B43** [3] 173–90 (1939).—K. reviews the properties of several glassforming systems such as B_2O_3–SiO_2, $MgSiO_3$–$CaSiO_3$, etc., whose end members form glasses. In these, the mol volumes depend linearly upon composition owing to the absence of any appreciable packing effects in these glasses. They are called "coordination glasses." Fusions were prepared from B_2O_3 and As_2O_3, and the specific gravities and refractive indices were determined. In addition, vitreous Sb_2O_3 was made, and the properties of the system B_2O_3–Sb_2O_3 were investigated. In these systems, mol-refraction and mol-volume curves indicated these properties to be additive, but slight deviations from linearity were found. K. believes, therefore, that in the latter system some of the Sb^{3+} acts as cations. Typically molecular compounds such as piperidine and phenolphthalein form fusions whose mol volume and mol refraction are additive, showing the absence of packing effects. For Part **II** see *Ceram. Abs.*, **19** [1] 10 (1940); see also *ibid.*, **20** [4] 90 (1941); **21** [1] 10 (1942). R.L.G.

Producing mineral wool. N. SPERANTOV. *Novosti Tekhniki*, **9** [19] 14–15 (1940); abstracted in *Chem. Zentr.*, **1941, I,** 2303.—At a Russian factory making thermoinsulation material, a mix containing clay marl and dolomite marl is smelted in a shaft furnace with additions of fluxes and coke. It is drawn off through a nozzle in a jet 15 to 20 mm. thick and is then subjected to a blast of air at 12 to 14 atmospheres and at a velocity of 800 m. per sec. The

molten mass is torn into very thin threads up to 3 μ in diameter; these are drawn into a collecting container by the steam and air currents where they mat into a woolly mass. When packed down, 1 cu. m. weighs 185 kgm. and has a coefficient of thermal conductivity of 0.035. M.V.C.

Production efficiency built into a factory. ANON. *Eng. News-Record*, **128** [8] 300–301 (1942).—A new manufacturing plant recently completed by the Owens-Illinois Can Co. at Clearing, Ill., has a 4 in. thick glass-fiber insulation on the ceiling to reduce noise. Glass blocks are used in both the interior and exterior walls to provide better lighting. Exterior walls are of brick with three bands of glass block, and locker rooms are of salt-glazed brick. Illustrated. G.A.K.

Production of optical glass in Australia. E. J. HARTUNG. *Nature*, **149** [3784] 518–19 (1942).—H. describes the difficulties encountered when the production of optical glass was undertaken in Australia in 1940. The properties of the glasses now being produced are well within the tolerance set by the Australian Optical Munitions Panel, and an abundant supply of excellent material for munitions purposes is ensured. G.A.K.

Proposed method for calculating the performance of glass tank furnaces. W. M. HAMPTON. *Jour. Soc. Glass Tech.*, **25** [111] 249–69T (1941).—By considering the basic heat-exchange equation, a logical mathematical method has been derived for determining the performance figure of a tank furnace, regardless of the type of glass melted and the melting temperature. The factors which affect fuel consumption are as follows: the temperature of the furnace, the size of the furnace, quality of the fuel used, design of the furnace, and rate of melting and of withdrawal. The analysis shows that insulation of the furnace refractories is likely to give greater savings in fuel than changes in design of the furnace structure. The color of the glass affects the performance figure owing to the differences in the heat-absorbing properties of colorless and colored glasses. R.H.B.

Report on round-robin tests of power factor and dielectric constant for glass. PHILIP A. RICHARDS. *Proc. Amer. Soc. Testing Materials*, **41**, 1183–97 (1941).—Recognizing the need for better coordination of test methods, Section B of Subcommittee V of the A.S.T.M. Committee D-9 met in Corning in 1935 to organize a study of this problem. From 5 commercial glasses representative of high- and low-loss types, 60 samples were prepared. The samples were circulated in a "round-robin" manner to 6 laboratories. The data from all laboratories were plotted on one curve for each type of glass. From these data it was concluded that, for accurate power-factor measurements, it is necessary to eliminate stray circuit components as far as possible and to evaluate correctly those remaining. The increase in power factor noted when the substitution method is used at higher frequencies is almost certainly due in part to resistance in the leads to the test condenser. The substitution method for measuring power factor described in A.S.T.M. Methods D 150 – 36T is satisfactory for glass when minor modifications are made. Recommendations for the modification of the standards in the light of the data presented are made. R.A.H.

Resistance of bottles to abuse. F. W. PRESTON. *Glass Ind.*, **23** [6] 217–21, 238 (1942).—Until recently, it was taken for granted that bottles were brittle and would break. Systematic investigation revealed that there was no more reason to expect them to fail than there was to expect a well-designed bridge to fall down. P. discusses only those factors in design and manufacture that affect resistance to abuse. With regard to manufacture, heterogeneity, unintentional ridges, and large bottles must be avoided. In design, the factors to be considered are (1) the junction of the base and side wall and (2) raised lettering or other sharp-contoured ridges. A.P.

Significance of the impurities in coal in the glass industry. UNITED GLASS BOTTLE MANUFACTURERS, LTD., TECHNICAL STAFF. *Proc. Combustion Appliance Makers Assn. 3rd Ann. Conf., April, 1939*; *Jour. Soc. Glass Tech.*, **25** [108] 88A (1941).—For general purposes the fuel should not contain more than 1% sulfur. In fire-polishing glass, town gas containing 12 to 20 grains of sulfur per 100 cu. ft. produced a bluish deposit which could not be removed by washing. In several cases the sulfur content of town gas was reduced by treatment with activated carbon; town gas was found suitable for fire-polishing if its sulfur content was below 8 grains per 100 cu. ft.

Solid-red selenium ruby glass. ANON. *Keram. Rundschau*, **46** [2] 16–17 (1938).—To obtain red selenium ruby from cadmium sulfide and selenium, materials which will color the glass batch in a strongly reducing atmosphere are added to the coloring mixture. The best composition for the base glass is given. M.V.C.

Solubility of sodium chloride in a soda-lime-silica glass. H. MARSHALL BATESON AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **23**, 265–67T (1939).—By melting increasing and excessive amounts of sodium chloride in the batches, it was found that a soda-lime-silica glass of the initial composition SiO_2 75, CaO 9.2, and Na_2O 15.8% dissolved sodium chloride at 1400° in amount equivalent to 1.42% Cl or 2.34% NaCl.

Specific gravity of CaO–Na_2O–SiO_2 glasses: XVI, Relation between the specific gravity and composition of glasses at ordinary temperatures. S. INOUE AND I. SAWAI. *Jour. Soc. Chem. Ind. Japan*, **43** [8] 241–43B (1940) (in German).—Of 8 methods for calculating the specific gravity of glass from the specific gravity of the separate oxides, that of Scholes is the best and that of English and Turner is much more accurate than the others. The other methods, in the order of decreasing validity, are those of Tillotson, Baillie, Finn and Thomson, Russ, Winkelmann and Schott, and Biltz. The values given show greater variations in the weights of oxides than in the weights of the compounds considered. The relation between specific gravity and composition may not hold for all glasses; for those considered here, however, the specific gravity of the glass may be closely estimated from the specific gravity of the compounds. **XVII, Relation between the specific gravity and composition of glasses at high temperatures.** *Ibid.*, pp. 243–45B.—The relation between specific gravity at high temperatures and the amount of CaO, $CaSiO_3$, Na_2O, or $Na_2Si_2O_5$ is similar to that at ordinary temperatures. The relation of the SiO_2 content to the specific gravity, however, is different at high temperatures, i.e., the SiO_2 content at 700° and 1000°C. either has no marked effect or has a different effect on the specific gravity. Apparently, the SiO_2 content at high temperatures had no effect on the specific gravity, as the CaO, Na_2O, $CaSiO_3$, or $Na_2Si_2O_5$ content shows a stronger effect than the free SiO_2. The specific gravity of glasses at high temperatures, as at ordinary temperatures, may be calculated within narrow limits from the relation between the specific gravity and the assumed compounds. The factors for the separate constituents of the glasses give different values for the oxides but not markedly different values for the compounds. At 1000°C., for a certain group of glasses, there is a lack of agreement between calculations by weight % and by mol. %; this is probably due, however, to scarcity of data and to experimental difficulties at 1000°C. For Parts **V–XV** see "Densities . . . ," *Ceram. Abs.*, **20** [1] 11–12 (1941). W.H.H.

Strength of glass-to-metal seals. C. J. MILNER. *Jour. Soc. Glass Tech.*, **23**, 308–28T (1939).—M. discusses bead seals of a particular glass on cylindrical wire of a metal which contracts more than the glass when cooled. It is found that the strength increases continually for increasing bead diameter on a given size of wire. For b/a (bead diameter/wire diameter) = 3, the strength is only 50% of that for b/a = 9. For constant b/a (= 9), the strength has a maximum for a certain angle of contact of glass and metal of about 40°. For this angle the strength is about 20% greater than for angles of 0° or 90°. It is shown that, as a consequence of these results, the maximum permissible stress measured at the center of a seal must depend on the shape and size of the seal. In favorable cases this maximum may be considerably greater than the limit of 1 kgm. per mm.^{2} set by A. W. Hull and E. E. Burger (*Ceram. Abs.*, **14** [6] 136 (1935)). Confirmatory experi-

ments are described which show that the results may be applied to practical cases, and application to a particular case is discussed.

Structure of evaporated films of chromium and aluminum on glass. ANNE R. OLIVER. *Phys. Rev.*, **61** [5–6] 313–14 (1942).—The structure of evaporated films on glass was investigated by electron diffraction. No evidence was found to indicate the nature of the hardening produced in aluminum films by using a chromium base or by washing with water. The oxide film on aluminum, if present, is very thin and amorphous. G.A.K.

Testing window glass for concussion damage. ANON. *Eng. News-Record*, **128** [14] 521 (1942).—The San Francisco Building Department has conducted tests on window glass to which taped and lacquered protection has been applied. G.A.K.

Theory of diffusion, viscosity, and electrolytic conduction. S. KANEKO. *Bull. Chem. Soc. Japan*, **15**, 276–80 (1940); *Jour. Soc. Glass Tech.*, **25** [108] 146A (1941).—The phenomena of diffusion and viscosity are intimately connected with electrolytic conduction, and all are treated as examples of the theory of reaction velocity in this paper. The results obtained are of a qualitative nature and require further development.

Theory of dispersion of light through opaque layers, in particular opaque glasses. W. HARTEL. *Licht*, **10** [7] 141–43; [8] 165; [9] 190–91; [10] 214–15; [11] 232–34 (1940); abstracted in *Physik. Ber.*, **22** [4] 470 (1941).—H. developed a mathematical formula for calculating the dispersion coefficients of opaque glasses on the basis of particle size and thickness of layer, making simple assumptions of uniform particle size and distribution. In general, the theoretically determined values are higher than those determined by experiment. M.H.

Three-dimensional forking of glass in breakage. F. W. PRESTON. *Jour. Soc. Glass Tech.*, **23**, 116–17T (1939).—P. describes a particular case of the columnar fracture of a pot of optical glass caused by reheating.

Toughened glass. J. T. LITTLETON. *Glass Ind.*, **23** [6] 223 (1942).—The principle of creating a stronger body by generating an internal tension to furnish a region under compression is being applied in the strengthening of glass. Carefully controlled cooling is an essential part of the process. This principle is now being applied to automobile windows, Pyrex brand Flameware, and Double Tough tumblers. For Flameware, treatment is such that it does not break into tiny pieces as does automobile safety glass but fractures in a more normal manner. A.P.

War conditions accelerate new glass uses. ANON. *Amer. Glass Rev.*, **61** [32] 10, 12, 15 (1942).—New uses for glass that in peacetime might take years to acquire large-scale application have been accelerated by war conditions. Fourteen instances where flat glass has replaced critical materials are cited. Toughened glass is being used in searchlights, spotlights, and floodlights, for increasingly larger areas on stoves, and in portholes and other marine applications. Eight desirable properties of flat glass are listed. See "Wanted . . . ," *Ceram. Abs.*, **21** [5] 101 (1942). A.P.

PATENTS

Adjustable nozzle for tempering bottles and other glass containers. C. E. MONGAN, JR. (Hartford-Empire Co.). U. S. 2,288,012, June 30, 1942 (Aug. 21, 1940).

Apparatus for coating fluorescent lamp tubing. E. T. CASELLINI (Hygrade Sylvania Corp.). U. S. 2,287,024, June 23, 1942 (Oct. 5, 1940).

Apparatus for continuously drawing and winding glass fibers. PIERO MODIGLIANI (Owens-Corning Fiberglas Corp.). U. S. 2,287,557, June 23, 1942 (March 3, 1939).

Apparatus for forming hollow glass articles. G. E. ROWE (Hartford-Empire Co.). U. S. 2,288,029, June 30, 1942 (Nov. 4, 1937).

Apparatus for making glass wool. DALE KLEIST AND GAMES SLAYTER (Owens-Corning Fiberglas Corp.). U. S. 2,287,006, June 16, 1942 (April 14, 1937).

Apparatus and method for feeding and fabricating glass. W. C. WEBER AND E. H. WELLECH (Corning Glass Works). U. S. 2,286,323, June 16, 1942 (Jan. 11, 1940).

Glass-bending frame. L. S. WHITMIRE AND C. A. JUNCKER (Pittsburgh Plate Glass Co.). U. S. 2,288,507, June 30, 1942 (July 27, 1940).

Glass-feeding device. J. T. WOOD. U. S. 2,288,381, June 30, 1942 (Aug. 20, 1938).

Glass-handling machine. S. F. GREIN AND P. G. MAGRINI (American Window Glass Co.). U. S. 2,285,921, June 9, 1942 (Oct. 30, 1937).

Glass-pressing apparatus. R. P. CASSELL (Jeannette Glass Co.). U. S. 2,287,512, June 23, 1942 (July 15, 1939).

Glassware-forming apparatus. G. B. LANGER (Lynch Corp.). U. S. 2,288,466, June 30, 1942 (Dec. 8, 1939).

High-tension insulator. VITALY GROSSE (General Electric Co.). U. S. 2,285,964, June 9, 1942 (Oct. 23, 1940).—A high-tension strain insulator comprising an insulating tube, strands formed from glass extending longitudinally of and compacted in the bore of the tube to form a unitary strain insulator member, supporting heads, and axially yielding means connecting the member to the heads.

Hollow glass block. J. J. GREGORY (Pittsburgh Corning Corp.). U. S. 2,288,521, June 30, 1942 (Jan. 27, 1940).

Lens-blocking apparatus. MAX SÜNSKES. U. S. 2,286,319, June 16, 1942 (Dec. 13, 1939).

Making glass wool. DALE KLEIST AND GAMES SLAYTER (Owens-Corning Fiberglas Corp.). U. S. 2,287,007, June 16, 1942 (April 14, 1937; Sept. 25, 1939).

Making mat of glass fibers. PIERO MODIGLIANI (Owens-Corning Fiberglas Corp.). U. S. 2,287,815, June 30, 1942 (March 3, 1939).

Making multiple containers. C. B. GARWOOD AND W. R. SCHLEHR (Carr-Lowrey Glass Co.). U. S. 2,285,707, June 9, 1942 (April 9, 1941).

Manufacture of glass barrels for syringes and of like tubular articles. S. J. EVERETT. U. S. 2,286,401, June 16, 1942 (Feb. 26, 1940).

Manufacture of sheet glass. EUGENE ROLLAND AND C. J. RICHTER (Adamston Flat Glass Co. and Rolland Glass Co.). U. S. 2,287,136, June 23, 1942 (July 17, 1939).

Method and apparatus for feeding glass stock. CLAUS SIEGFRIED (Owens-Corning Fiberglas Corp.). U. S. 2,286,653, June 16, 1942 (March 28, 1939).

Method and apparatus for making bonded fibrous products. H. W. COLLINS (Owens-Corning Fiberglas Corp.). U. S. 2,288,072, June 30, 1942 (June 22, 1938).

Opaque apertured signal lens. C. L. FARRAND AND H. S. NEWCOMER. U. S. 2,286,201, June 16, 1942 (April 5, 1939).

Reclaiming safety glass. F. W. HALL (Pittsburgh Plate Glass Co.). U. S. 2,288,524, June 30, 1942 (May 18, 1940).

Tempering glass. J. T. LITTLETON, H. R. LILLIE, AND W. W. SHAVER (Corning Glass Works). U. S. 2,285,595 and 2,285,596, June 9, 1942 (Sept. 12, 1939).

Treating borosilicate glasses. H. P. HOOD AND M. E. NORDBERG (Corning Glass Works). U. S. 2,286,275, June 16, 1942 (Sept. 10, 1940).—The process which includes melting a glass comprising approximately 62.7 SiO_2, 6.6 Na_2O, 3.5 Al_2O_3, and 26.9% B_2O_3, fabricating the glass into a fixed shape, heating the article at about 580°C. for about 3 hr., cooling it at the rate of about 25° per hr. to below 550°C., then cooling it more rapidly to room temperature, and leaching the heat-treated article in an acid solution.

Structural Clay Products

Applying separating agent on brick pavements. ANON. *Eng. News-Record*, **128** [9] 356 (1942).—An apparatus is described which aids in keeping the separating agent for removing excess joint material on brick pavements from flowing into the joints and preventing the desired adhesion of the asphalt filler. G.A.K.

Army warehouse design saves steel. ANON. *Eng. News-Record*, **128** [5] 204–206 (1942).—An unusual design

was prepared for six large warehouses to be built at Voorheesville, N. Y. The design, which made possible a large saving in steel, and the rapid construction methods followed are described. A major saving in steel was accomplished by the substitution of brick arch lintels for reinforced concrete or steel lintels. Materials required for one structure include 1,300,000 standard common brick. G.A.K.

Bombproof shelters. ANON. *Brick & Clay Record*, **100** [3] 32, 34, 36 (1942).—Construction details for brick and concrete shelters are given. See *Ceram. Abs.*, **21** [7] 143 (1942). B.C.R.

Candid comments on clayworks matters. F. W. JOLLY. *Claycraft*, **15** [8] 198–202, 213–15 (1942).—J. discusses the following factors in a heavy clay plant: (1) engineers, (2) maintenance tools, (3) boilers and fuel, (4) steam engines, (5) electric motors, (6) pan mill, (7) grids, (8) screens, (9) mixer, (10) rolls, and (11) pug mill. G.A.K.

Carbonation of lime-sand building materials. P. A. PSHENITSYN AND Z. L. BORISOVA. *Zhur. Priklad. Khim.*, **12**, 1790–1801 (1939).—The hardening of lime-sand solutions in the air depends upon the development of the periodicity of the carbonation process of $Ca(OH)_2$ present in the solution of lime. The samples measured 7 x 7 x 7 cm. and were prepared from lime (slaked) and powdered $Ca(OH)_2$. The composition of the solution of a plastic consistency corresponded to 1 : 5 by weight when using Lyuberetskiĭ quartz sand, calculated on dry hydrate. The samples were kept in the laboratory, after the removal of the molds, for one month. Some samples were left in the air, while others were placed in an atmosphere of CO_2. The dry samples were cut in half, and the cutting surface was carefully blown with dry air and tinted with a 1% thymolphthalein in 75% alcohol. The periodicity (rhythm) appeared after 1 to 2 min. The periodicity of carbonation depends upon the volume of the aggregate grain of $Ca(OH)_2$. It lies within certain limits of the partial pressure of CO_2 and is typical for samples kept in the air. The periodicity of the carbonation disappears on increase of the partial pressure. Material prepared in autoclaves (silica brick) has no periodicity of carbonation due to its greater structural strength. The lime mortar, depending upon the method of slaking and the limestone used in burning, is characterized basically by the volume of the aggregated grains. The size of the aggregated grain can be changed by treating the lime accordingly. A.A.B.

Cause and prevention of the formation of blisters on brick. ANON. *Schweiz. Tonwaren-Ind.*, **44**, 4–6 (1941); abstracted in *Chem. Zentr.*, **1941, I,** 2301.—Blisters are caused by the generating of gas; they occur especially in fat clays with high humus content and originate at different stages of production, occasionally after the brick leave the wire cutter. Drying in air containing too much moisture may produce blisters, and they may also occur during firing. If the clay contains considerable quantities of calcium carbonate and iron pyrites, blisters will probably be formed. Measures to be taken in each case are discussed. M.V.C.

Lining canals with brick. W. I. GILSON. *Eng. News-Record*, **128** [9] 350–52 (1942).—G. discusses the advantages of reinforced brick lining for canals under the following headings: (1) cost of lining, (2) staking out, (3) shaping canal, (4) placing reinforcing, (5) placing brick, (6) application of mortar, and (7) curing. Illustrated. G.A.K.

Poor workmanship cause of building failures. ANON. *Brick & Clay Record*, **100** [3] 36 (1942).—Recent bombings in England resulting in the destruction of brick buildings have revealed that poor workmanship in their erection was one of the major causes for their failure to withstand these attacks. Poorly filled mortar joints and the use of insufficient cement in making up the mortar were the main causes of failure. B.C.R.

Saturation coefficient values for brick by the absorption-boiling and absorption-porosity methods. R. T. STULL AND PAUL V. JOHNSON. *ASTM Bull.*, No. 109, pp. 17–18 (1941).—The absorption-porosity ratio shows substantially the true relation between the pore-filled volume and the total pore volume of the brick; inasmuch as this is not always shown by the absorption-boiling method, the former ratio should be more reliable in predicting the behavior of a brick in the freezing-thawing test. The greatest differences between corresponding saturation coefficients obtained by the two methods are found among brick made from deaired fine-grained plastic clays such as the plastic fire clays and the fine-grained sedimentary clays. Data obtained are insufficient to determine a maximum allowable saturation coefficient. Porosities were determined by the air-expansion method. B.C.R.

Stability to frost of highly porous material. N. ROYEN. *Tek. Tid.*, **70** [43] 129–31 (1940); abstracted in *Chem. Zentr.*, **1941, I,** 2017.—To determine the stability to frost, R. recommends that the changes in length of test pieces (5 x 7 x 20 cm.) during freezing (to about −26° to −30°) and thawing be measured. The method is illustrated by a table of curves. The determination of the permanent change in length after saturation in water, freezing, thawing, and drying to the original weight is more important than the course of the curve. From the standpoint of technical construction, it is important to prevent the penetration of moisture into the material by condensation. M.V.C.

SEPARATE PUBLICATION

Tests of Face Brick from Illinois and Other States. C. W. PARMELEE. *Illinois State Geol. Survey Rept. Investigations*, No. 64, 32 pp. (1940).—Standard tests for color, uniformity of size and shape, absorption, density, soluble salts, compressive strength, transverse strength, and hardness were made on representative lots of samples of face brick manufactured in Illinois, Indiana, Ohio, and Pennsylvania. The brick from the last three states were selected because they were sold competitively in the Illinois market with the Illinois brick. Twenty-four lots of samples were tested from Illinois, 15 from Indiana, 5 from Ohio, and 6 from Pennsylvania. Similar data obtained from other sources are given for 9 lots of samples of face brick from Oklahoma and 11 from Virginia, a total of 70 lots of samples. The results of these tests are compared with standard specifications and with each other; they show that face brick produced in Illinois have properties far better than those required by Federal Specifications, the Building Code Committee of the U. S. Dept. of Commerce, the American Society for Testing Materials, and the American Face Brick Association. The Illinois face brick compare favorably with or are superior to face brick produced in the other states mentioned. G.A.K.

PATENTS

Brick to facilitate the insertion of rods or pipes into brickwork. H. W. COURT. Brit. 545,064, May 20, 1942 (March 8, 1941).

Bricklaying instrument. L. W. CARR. U. S. 2,286,669, June 16, 1942 (Oct. 15, 1940).

Building block. C. R. WILSON. U. S. 2,285,693, June 9, 1942 (Dec. 27, 1938).

Building brick or block. R. J. DICKHOUT. U. S. 2,287,979, June 30, 1942 (Jan. 29, 1940).

Refractories

Chemical analysis of refractory clays as a rapid method for determining their rational composition: I. E. DRECHSEL. *Arquitectura Portuguesa*, **34** [75] 19 (1941); *Trans. Brit. Ceram. Soc.*, **41** [2] 30A (1942).—The importance of distinguishing between the chemical and mineralogical analysis is emphasized. The following constituents of clay are recognized: clay substance; quartz; oxides, carbonates, silicates, and sulfates of iron; carbonates of lime and magnesia; and mica. Elutriation is considered only an approximate method of determining the amount

of clay substance present. The method involving decomposition with sulfuric acid is described; the acid attacks the clay, while the quartz, feldspar, and mica are unaffected. A further method involves decomposition of the clay molecule by heating to 200°C.; treatment of the heated sample with hydrochloric acid gives $AlCl_3$ and SiO_2, which may then be determined.

Extraction of alumina from aluminous raw materials: I, Extraction of alumina from high-alumina clay with alkali solution under high pressure. T. SUZUKI. *Jour. Soc. Chem. Ind. Japan*, **43** [9] 287–88B (1940) (in English).—The four kinds of raw materials of high alumina content selected are composed essentially of diaspore and kaolinite. The powdered sample, mixed with sodium hydroxide solution and autoclaved under high live-steam pressure, was stirred at 32 r.p.m. The molecular ratio of Al_2O_3 : Na_2O was 1 : 1.73, and the volume of alkali solution was 500 cc., the quantity of sample and concentration of solution being varied. After being autoclaved and cooled, the dissolved alumina and silica were analyzed, and the weight of insoluble residue was measured. With 10% alkali concentration and a pressure of 70 kgm. per cm.², about 90% alumina was dissolved; the same yield was obtained with 20% concentration and a pressure of 40 kgm. per cm.² If the sample is calcined at 300° to 500°C., the ease of extraction of alumina is increased; extraction becomes difficult, however, if the temperature is raised above 700°C. **II, Hydrolysis of sodium aluminate solution.** *Ibid.*, pp. 288–89B.—Sodium aluminate solution (200 cc.) was placed in a conical flask, and 2.9 gm. of aluminum hydroxide were added as a "seed" charge. After agitation, the solution was left standing several hours, and the percentage of hydrolysis of sodium aluminate was determined. Measurements were made at intervals until equilibrium was reached. From these and other tests under varied conditions, S. concludes that the best conditions for the production of alumina through the hydrolysis of aluminate solutions are as follows: (1) concentration of alumina in solution, 0.08 to 0.12 gm. per cc.; (2) molecular ratio of alumina to alkali in solution, 1 : 1.5 to 1 : 1.8; (3) charge of $Al(OH)_3$ to be added to the solution, 10 to 20 gm. per liter; and (4) temperature of hydrolysis, 30° to 40°C.
W.H.H.

Insulating firebrick in modern furnace construction. N. ALLEN HUMPHREY. *Blast Furnace & Steel Plant*, **29** [12] 1197–1201 (1941).—Studies show that periodic operating furnaces lined with insulating firebrick are more economical and more flexible in heating and cooling than those lined with firebrick. A performance cost analysis, based on Schmidt graphs, shows that the annual cost of the insulating firebrick is only one third that of firebrick.
B.L.

Investigation of the heating-up process of a furnace lining and a new method of calculating linings. I. RAFALOVICH. *Stal*, **1940**, No. 5–6, pp. 36–43; *Jour. Iron & Steel Inst.*, **144** [2] 154A (1941).—R. studied the heating up of an experimental furnace wall under conditions of normal, excess, and reduced air pressure within the furnace. The results plotted graphically are compared with those derived by several analytical methods, some of which under certain conditions gave satisfactory results. A new method of calculating the heat losses when heating up the furnace walls is given. The method is based on an analysis of experimental results and is applicable also for excess or reduced pressure conditions within the furnace, provided gas leakage through the walls is prevented. The application of the method to the choice of an optimum wall design for a given furnace heating-up curve is illustrated.

Kyanite refractories. R. P. HEUER, Chairman of the Non-Metallic Group of the Advisory Committee of Metals and Minerals of the Office of Production Management. *Brick & Clay Record*, **100** [3] 50–51 (1942).—The outstanding properties of kyanite refractories are as follows: (1) high softening point (P.C.E. 38), (2) low subsidence under load at elevated temperatures, (3) resistance to thermal shock, and (4) volume stability. The last property is particularly desirable in Ajax-Wyatt induction furnaces where the formation of cracks leads to short circuits from a penetration of metal. Although kyanite is used extensively in the brass-melting field, 75% or more of the brass is sufficiently below melting to permit the use of a smaller amount of refractory materials. For the higher melting copper alloys, fire-clay refractories are unsatisfactory; their life would be only 10% that of kyanite refractories. In ferrous melting, 60% alumina, fused alumina, and magnesia brick give as satisfactory service as kyanite. Kyanite is used to some extent in direct-arc electric furnace roofs, where it gives longer life than silica although the initial cost is considerably higher. About 50% of all kyanite refractories are used in the metallurgical field. In the glass industry, kyanite is used in some critical spots in the superstructure of tanks, especially where dusty conditions prevail. Kaolin appears to be the most suitable substitute for kyanite for this purpose. In the manufacture of large shapes, kyanite is particularly suitable because of its volume stability. For uses requiring high refractoriness, high density, and resistance to thermal shock, kyanite occupies an enviable position.
B.C.R.

Magnesinter, a new Italian refractory material of magnesite. L. POMPEI. *Metallurgia Ital.*, **32**, 291–94 (1940); abstracted in *Chem. Zentr.*, **1941, I,** 2014.—Natural magnesite was ground, mixed with activating and stabilizing material, molded into pressed forms, and sintered at 1520° to 1540°. The block obtained began to soften at about 1695°, while other magnesite block tested began to soften at lower temperatures. The possibilities of application of these block are discussed.
M.V.C.

Magnesite industry during the war. H. KALPERS. *Bergbau*, **54**, 54–57 (1941); abstracted in *Chem. Zentr.*, **1941, I,** 2437.—As chrome ore has not been available in large amounts for the manufacture of chrome-magnesite block since the beginning of the war and such block are sensitive to the action of iron oxide and lime, special magnesite block without chrome were developed which had high resistance to pressure and heat and to temperature change. These block are used to a great extent in burners, in gas and air flues, and in the breast wall of Siemens Martin furnaces. Other applications are discussed.
M.V.C.

Modern arc furnace design and practice. H. F. WALTHER. *Iron & Steel Engr.*, **18** [1] 22–32 (1941).—An increase in atmospheric volume gives longer lining and roof life. The tilting-top furnace is limited to small installations where flexing of the roof brick and electrode columns is at a minimum. Top-charge furnaces are efficient up to a diameter of about 16 in. The enlargement of door openings and charging boxes would facilitate the handling of light bulky scrap. Rammed-in bottoms may have 60 to 70% MgO in comparison with 50% for fired-in bottoms. Silica brick roofs are preferable to clay brick roofs partly because impending failure is more easily detected. Electric furnaces are well adapted to the remelting of oxidizible scrap alloys with a minimum of loss. Graphite mold plugs are proving satisfactory.
B.L.

New ceramic material for heavy duty. ERIK HALLSTRÖM. *Tek. Tid.*, **70** [32] 62–64 (1940); abstracted in *Chem. Zentr.*, **1941, I,** 2161.—The properties of the sintered oxides (Al_2O_3, sintered spinel, BeO, ZrO_2, and MgO) and their use as ceramic work materials are described.
M.V.C.

Notable progress made in use of refractories in 1940. A. M. MORTON. *Blast Furnace & Steel Plant*, **29** [1] 48–50 (1941).—Seawater magnesite is being used in the construction and maintenance of open-hearth furnace bottoms. Other developments include (1) use of cold setting refractory materials, (2) the moving of the brick line closer to the contour of the bath, (3) use of air cooling for basic walls, (4) use of deaired brick for checkers, (5) use of high-alumina clay brick to replace chrome brick for furnace bottoms, (6) use of corundum brick in rod billet and heating furnaces, (7) use of chrome base cement to tamp in door linings, and (8) increased cooling of stacks of blast furnaces. Carbon brick and chrome magnesite have possibilities for the lining of iron ladles.
B.L.

Open-hearth insulation. E. H. YOUNGLOVE. *Blast Furnace & Steel Plant, Conf. Supp.*, **29** [4] 37–39 (1941).—

In current practice, the areas above and below the charging floor are insulated. Insulation of open-hearth regenerators decreases unit fuel cost, increases speed of heats, diminishes air leakage, and increases flue temperature to waste-heat boilers. Roof insulation is advantageous if operating conditions are controlled. Directions are given for the insulation of regenerators, fantails, slag pockets, flues, and the area above the charging floor. B.L.

Open-hearth problems and improvements in 1940. H. M. GRIFFITH. *Blast Furnace & Steel Plant*, **29** [1] 58–60 (1941).—Changes in the pig-scrap ratio have led to the production of low silicon basic iron (0.60 to 0.80% Si average) with a high physical temperature and a normal sulfur content. Basic-brick shoulders along the front and back skewbacks are not yet successful. Magnesite refractories for bottoms seem to develop a high resistance to slag and metal attack. Granular dead-burned dolomite rammed into place dry forms a very dense mass for bottoms. Composite nozzles of basic and clay materials are suitable for material with low pouring rates and freedom from inclusions. Liquid-fuel furnaces are reversed by means of an air- or steam-operated valve at the burners. Coarse-grained materials are giving improved results for ladle refractories. Mold coatings of sprayed tar residue save time and material in comparison with dipping. B.L.

Paradox in the theory of heat conduction. G. JAFFÉ. *Phys. Rev.*, **61** [9–10] 643–47 (1942).—The classical theory of heat conduction leads to infinite values for the heat current and for the propagation of temperature at $t = 0$, if the initial conditions involve a discontinuity in the temperature distribution. These paradoxical results can be avoided if a method previously indicated by J. is applied. The solution of a fundamental problem in gaseous heat conduction is given to a first approximation. This holds for values of the distance from the discontinuity which are smaller than the mean free path and for times which are smaller than the time required for a molecule to travel over a mean free path with the mean velocity. The new solution is compared with the classical one, and it is shown that all results of the latter which are devoid of physical sense disappear. It is shown, by graphical interpolation, how the new solution changes into the classical one. G.A.K.

Refractories service conditions in the blast furnace. HOBART M. KRANER. *Jour. Amer. Ceram. Soc.*, **25** [11] 311–20 (July, 1942).—75 references, 11 figures.

Specifications and tests from the refractories maker's point of view. G. V. EVERS. *Jour. Soc. Glass Tech.*, **23**, 118–28T (1939).—E. experienced difficulties in applying existing specifications for refractory materials. Specifications which require greater consistency and preciseness of definition are discussed.

Survey of literature on slag tests for refractory materials. T. L. HURST AND E. B. READ. *Jour. Amer. Ceram. Soc.*, **25** [11] 283–94 (July, 1942).—166 references.

PATENTS

Corrected basic refractory. G. E. SEIL (E. J. Lavino & Co.). U. S. 2,287,455, June 23, 1942 (Oct. 11, 1940).—The process of making refractory material of periclase and calcium orthosilicate bonded with calcium aluminate which comprises using a lime-magnesia starting material such as dolomite, mixing therewith starting materials that yield both alumina and silica in calculated amounts, and raising the temperature of the mix to approximately 3100°F., i.e., a point below the fusion point of the mass but above that at which chemical equilibrium is reached between the reactant constituents, by which calcium aluminate is formed first and thereafter stabilized calcium orthosilicate, whereby there is yielded a reaction product containing neither free lime nor free silica but including periclase and calcium orthosilicate as the refractory and major components, of which calcium orthosilicate forms substantially not less than 50% by weight of the refractory material with a bonding and minor component of calcium aluminate as the major portion of the bonding component, the amount of alumina added being such as to yield not less than substantially 5% of Al_2O_3 in the finished product and to leave the lime of the starting material in molecular excess and the amount of silica added being such as to provide the molecular percentage of the residual lime remaining after formation of the calcium aluminate in twice the molecular percentage of the silica in the mix.

Production of alumina from aluminous materials. W. C. DEVEREUX AND W. E. PRYTHERCH. Brit. 545,000, May 20, 1942 (March 6, 1941).

Recovering alumina. J. C. SÉAILLES AND W. R. G. DYCKERHOFF. Brit. 545,149, May 28, 1942 (Aug. 2, 1937).

Zircon refractories and refractory compositions and methods of making. H. W. K. JENNINGS (Titanium Alloy Mfg. Co.). Brit. 545,239, May 28, 1942 (June 17, 1941).

Terra Cotta

Industrial uses of stoneware. ANON. *Engineering*, **153** [3981] 343–44 (1942).—The physical properties, chemical composition, raw materials, uses, and methods of manufacture of various types of stoneware are discussed. G.A.K.

Pottery—fireproof cooking utensils. ANON. *Keram. Rundschau*, **45** [52] 599–600 (1937).—The body of brown ware is made porous so that the engobe will adhere better. For fireproof cooking utensils, the body is compact and is fired to the sintering temperature. Requirements of the body and the glaze are given, and the manufacture of fireproof cooking utensils is described. M.V.C.

Reflection factors of floor materials. PARRY MOON. *Jour. Optical Soc. Amer.*, **32** [4] 238–42 (1942).—A distinct improvement in the level of illumination on the work and in the quality of lighting is obtained by increasing the reflection factor of the floor. One hundred twenty-nine samples of flooring material were tested (see "Colors . . .," *Ceram. Abs.*, **20** [11] 265 (1941)). With large rooms having relatively low ceilings, the floor becomes an important element in lighting. In one case, a change from dark-gray to light-gray tile saved 20% in lighting, but the principal advantages are the improved visual conditions resulting from reduced contrasts and the increased cheerfulness. A.P.

Reflection factors of materials used in schoolrooms. PARRY MOON. *Jour. Optical Soc. Amer.*, **32** [4] 243–46 (1942).—Total reflection factors and trichromatic coefficients were obtained for daylight and incandescent light on school chalkboards, wall and ceiling paints, Venetian blinds, and window shades. Eight glass chalkboards of various colors were tested and compared with slate chalkboards. See "Colors . . .," *Ceram. Abs.*, **20** [11] 265 (1941). A.P.

Whiteware

Gasification in the firing of tile. W. STEINER. *Keram. Rundschau*, **46** [4] 40 (1938).—The high rate of breakage of mosaic tile when taken from a circular kiln is caused by gasification. The main cause of gasification is inadequate control of the fuel gases during firing. The sintering temperature interval must be especially watched to prevent a reducing atmosphere from prevailing in the furnace. In practice, 1.3 to 2 times the quantity of excess air should be used during firing. M.V.C.

Hybrid electrical porcelain developed. ANON. *Elec. Eng.*, **61** [2] 79 (1942).—A new method which embodies the advantages of both the wet and dry processes of manufacturing electrical porcelain is briefly described. In a dry pan, moisture is added to the previously mixed dry ingredi-

ents. The prepared material of low moisture content is subjected to high pressures to eliminate voids and to produce a continuous structure. As a consequence, absorption is small, and, in general, the properties of pieces made by the wet process are equalled or slightly improved.

R.L.G.

Influence of fluxes of spodumene and feldspar mixtures on properties of chinaware bodies. H. G. SCHURECHT, J. K. SHAPIRO, AND Z. ZABAWSKY. *Jour. Amer. Ceram. Soc.*, **25** [11] 321–26 (July, 1942).—3 references, 6 figures.

Preparation of whiteware bodies. ANON. *Keram. Rundschau*, **45** [46] 530–31 (1937).—Three methods of preparation are described, and their costs are compared: (1) A suspension is made of the clay and the raw kaolin; the hard raw materials are ground wet. The dry weights of the clay slip, raw kaolin, and mixtures of the different raw materials are determined. (2) Clay and kaolin are made into a suspension in combination with whiting, and the remaining raw materials are finely ground; the entire body is produced in one process. (3) A suspension is made of clay and kaolin, the dry weight is determined, and the suspension is mixed with the remaining finely ground raw materials. The first process proved most economical.

M.V.C.

Resistance to temperature changes and life of ceramic ware. GEORG HOCHHAUSER. *Sprechsaal*, **73** [51] 471–73 (1940).—The investigation of batch materials which promote resistance to temperature changes and their influence on the different characteristics of the ware, such as vitrification, melting point, bending strength, color, absorption, etc., presents a noteworthy field of research, of which only a relatively small part can be considered. Silicon carbide has a much higher heat conductivity than other ceramic bodies. Its melting point is over 2000°C. and its coefficient of expansion is very low, but it is expensive. Porous materials resist temperature changes, and ceramic ware may be made porous by mixing combustible material with the body. Some clays, like shale, resist temperature changes well, but sandy clays should be avoided because of the expansion due to conversions of silica at certain temperatures. Grog is used in a batch to reduce the plasticity; talc has a favorable effect on various properties such as the melting point. Magnesite is used much more frequently than talc and has similar effects. The talc should be mixed dry with the other materials of the body; otherwise a homogeneous mixture cannot be obtained. Talc or magnesite is used to increase the life of cooking vessels which are exposed to great changes of temperature. Fired clay is a poor conductor of heat; when a vessel is placed on the stove, the bottom heats suddenly but the heat spreads only slowly to the other parts of the vessel. This may cause the bottom to break off. Table I shows the results of tests on three bodies used in making casseroles. The resistance to temperature changes was determined as follows: The casseroles, containing water at 15°C., were subjected to constant heating on an evenly heated hot plate. If the casserole was uninjured 1 min. after the water had completely evaporated, it was set aside to cool. The number of times this test could be repeated before the casseroles cracked badly enough to leak was a measure of their resistance to temperature changes. Bodies 1, 2, and 3 were unsatisfactory. The deformation and the vitrification were too great, although the resistance to temperature changes was somewhat improved. After further trials, a new body, No. 4, was made up with 1.6% talc by weight, and the casseroles were tested as before. The distortion of the bottom was at most 3 to 5 mm. in a diameter of 280 mm. The workmen objected to throwing this body because of the relative coarseness of the grog, but they were persuaded when the reasons for using this body were explained to them. To determine the general utility of talc when used in large amounts, three bodies were prepared: (5) a very fat blue clay, (6) a mixture of 6 parts shale, 5 parts refractory clay, and 9 parts grog, and (7) the same body for brown ware as body No. 1, Table I. Table II shows the results of tests.

TABLE I

	Body No. 1	Body No. 2	Body No. 3
Addition of talc (%)	0	3	5
Water (%)	18	18	18
Kabus softness value	30	26	25
Shrinkage on drying (%)	6	5.8	5.2
Total shrinkage (%)	9.4	10.0	10.8
Absorption, 24 hr. (%)	4.2	3.8	3.2
Color when fired to Seger cone 10	Bright yellow	Sprinkled with gray-yellow	Irregularly sprinkled with gray

TABLE II

	Body No.	Ratio of body to talc 100:0	90:10	80:20	70:30
Mixing water (cc./kgm.)	5	320	320	310	300
	6	190	190	190	200
	7	180	180	180	180
Kabus softness value	5	29.7	28.9	23.4	15.4
	6	5.3	11.6	17.4	45.0
	7	25.0	32.4	39.8	56.5
Drying shrinkage (%)	5	6.3	6.2	5.9	5.7
	6	3.0	3.2	3.2	2.7
	7	5.8	5.5	5.0	4.5
Total shrinkage (%) fired at Seger cone 10	5	16.4	12.3	10.3	10.2
	6	5.4	4.9	4.3	3.4
	7	9.8	9.2	7.8	6.6
Intensified absorption test (%)	5	0.59	1.14	1.68	2.70
	6	20.47	19.23	18.30	20.78
	7	6.60	5.28	4.31	3.91
Color when fired	5	Bright gray	Dark gray	Gray-brown	Brown
	6	Color of wheat	Reddish yellow	Brownish yellow	Brownish
	7	Bright yellow	Gray	Dark gray-brown	Dirty brown-gray

The decreased absorption of body No. 7 in the 70:30 mix is noteworthy, as is also the action of the clay glaze on a body containing talc. Body 7 with about 12% talc causes a severe discoloration of the otherwise shiny brown glaze. When the talc content is increased to about 40%, there is a dulling and a bleaching to an insignificant brown-gray. A chemical interaction occurs between the clay glaze and the body containing magnesium. W.H.H.

Talc porcelain: XVIII, Electrical properties of bodies in the high-frequency field. S. KONDO AND S. SUZUKI. *Jour. Soc. Chem. Ind. Japan*, **43** [7] 206B (1940) (in English).—The authors found, from an examination of 29 steatite bodies, that the power factor and the dielectric constant decrease as the frequency increases, especially with bodies rich in alumina. For a given frequency, the power factor tends to decrease with increase in the content of magnesia and silica. Bodies with low power factor show a comparatively high dielectric constant. **XIX, Variation of power factor and dielectric constant with temperature and humidity.** *Ibid.*, pp. 206–207B.—Tests were made on 18 bodies at frequencies of 1000, 2000, and 4000 kc. at 5 temperatures between 20° and 300°C. The effect of humidity was found by testing bodies which had been soaked in water for 24 hr. The power factor and the dielectric constant increase with temperature; the effect of moisture is inversely proportional to the frequency and increases as the surface resistivity decreases. **XX, Microstructure.** *Ibid.*, p. 207B.—Two kinds of talc and 15 bodies containing talc were examined. Highly talcous steatite consists mainly of forsterite; the amounts of mullite and magnesium glass increase with increase in the content of alumina. Cristobalite does not cause the dissociation of talc, which may be due to the presence of quartz. Siliceous bodies contain large pores, while aluminous bodies have minute pores. If a flux is used, however, the former may show a compact structure. The microstructure of the low-talc steatite is very complex and mainly granular, consisting of mullite or cordierite, depending on the content of talc and alumina. For Parts **XVI** and **XVII** see *Ceram. Abs.*, **19** [1] 18 (1940). W.H.H.

PATENTS

Ceramic articles suitable for use as electrical insulators. GENERAL MOTORS CORP. Brit. 544,967, May 20, 1942 (May 31, 1940).

Insulator. C. D. CROSKEY AND D. H. ROWLAND (Locke Insulator Corp.). U. S. 2,287,976, June 30, 1942 (June 27, 1940).—The combination with an insulator body of ceramic material having a coefficient of expansion of the nature of 5.8 to 6 $\times$ 10^{-6} of ceramic glazing material therefor, the glazing material having a coefficient of expansion of the order of 5.3 $\times$ 10^{-6} per °C., a band of ceramic sand applied to the insulator body after it has been coated with the ceramic glazing material, the sand having a coefficient of expansion less than 5.3 $\times$ 10^{-6} per °C., the body, glaze, and sand being adapted to be vitrified simultaneously.

Production of densely sintered ceramic masses. KARL SCHUSTERIUS (Rosenthal-Isolatoren G.m.b.H.). U. S. 2,287,538, June 23, 1942 (Sept. 22, 1937).—A process of manufacturing dense ceramic materials, such as for electrical insulators, comprising the steps of forming a finely divided mixture consisting of about 30 to 60% of slag obtained from calcium phosphate in the presence of reducing elements and silicate-containing materials such as sand in an electric furnace, the remainder substantially consisting of silicate selected from aluminum and magnesium silicates, shaping, and finally sintering the mixture into a dense body.

Spark plug. GENERAL MOTORS CORP. Brit. 545,069, May 20, 1942 (July 3, 1940); addition to Brit. 494,701.

Spark plug and method of making. GENERAL MOTORS CORP. Brit. 545,068, May 20, 1942 (July 27, 1940); addition to Brit. 494,701. S. H. STUPAKOFF (Spark King Corp.). U. S. 2,286,515, June 16, 1942 (Sept. 11, 1940).

Spool insulator. L. E. JOHNSON (Porcelain Products, Inc.). U. S. 2,286,488, June 16, 1942 (July 24, 1940).

Equipment and Apparatus

American recommended practice of industrial lighting. ANON. *Illum. Eng.*, **37** [5] 279–320 (1942).—This Recommended Practice of Industrial Lighting has been approved by the Sectional Committee, organized under the procedure of the American Standards Assn., and by the Illuminating Engineering Society. Illumination is a factor of primary importance which affects the environment of every industrial establishment. The beneficial effects of good illumination, both natural and artificial, have been established in extensive tests over many years. The advantages to industry are (1) greater accuracy of workmanship, resulting in an improved quality of product with less spoilage and rework; (2) increased production and decreased costs; (3) better utilization of floor space; (4) greater ease of seeing, especially among older employees, thus making them more efficient; (5) more easily maintained cleanliness and neatness in the plant; (6) less eyestrain among employees; (7) better supervision of workers; (8) improved morale among employees, resulting in decreased labor turnover; and (9) greater safety. Specific installations are shown in thirty illustrations and discussed. Recommended minimum values are as follows:

Clay products and cement plants	
Grinding, filter presses, kiln rooms	5 ft.-c. in service
Molding, pressing, cleaning, and trimming	10 " " "
Enameling	15 " " "
Color and glazing	20 " " "
Glassworks	
Mixing and furnace rooms, pressing and lehr, glass blowing machines	10 ft.-c. in service
Grinding, cutting glass to size, silvering	20 " " "
Fine grinding, polishing, beveling, etching, and decorating (*C*)	50 " " "
Inspection (*B*) (*C*)	

B: This group of visual tasks involves the discrimination of fine detail under conditions of a fair degree of contrast for long periods of time. Illumination levels from 50 to 100 foot-candles are required. *C:* The seeing tasks of this group require the discrimination of fine detail by utilizing (*a*) the reflected image of a luminous area or (*b*) the transmitted light from a luminous area. The proper and adequate maintenance of equipment is essential for both natural and artificial lighting. Systems which are adequate when first installed will soon deteriorate unless properly maintained. A regular, definite system of maintenance should be established to insure that skylights, side windows, lamps, and accessories are at all times kept clean, in proper adjustment, and in good repair. To insure the maintenance of a given illumination even where conditions are favorable, it is necessary to design the system to give initially at least 25% more light than the required minimum. In locations where dirt collects rapidly and where adequate maintenance is not provided, the initial value should be at least 50% above the minimum requirement. H.K.R.

American Standard correlates requirements for test sieves. LINCOLN T. WORK. *Ind. Standardization*, **11** [3] 63–65 (1940).—The new American Standard for Sieves for Testing Purposes (Z23.1-1939; A.S.T.M. E11-39) includes specifications for fine and coarse sieves and perforated metal screens, dimensions, and tolerances but no requirements as to methods of agitation. It includes five new coarse sieves, extending the fourth root of two series. Fine sieves are designated by their size of opening in microns and by a sieve number. Tolerances and limits have been revised on the basis of experience. Wire diameters are stated between two limits, and no nominal size is given. The Tyler Series and the U. S. Sieve Series have been commonly used in the fine sizes and also in the coarse sizes. The two fine series followed the fourth root of two (1.19) as the ratio between apertures of two successive

sizes, and they differed by only 1 or 2%. Standard sieves should be labeled to show (1) the mesh number, (2) the name of the series, (3) the manufacturer, and (4) the opening in inches and in millimeters. W.D.F.

Construction and use of X-ray powder cameras. A. J. BRADLEY, H. LIPSON, AND N. J. PETCH. *Jour. Sci. Instruments*, **18** [11] 216–19 (1941).—A description is given of a Debye-Scherrer camera (19 cm. diameter). G.A.K.

Control and collection of industrial dust: I. E. D. POWERS. *Rock Products*, **45** [2] 58–60 (1942).—Types of dust collectors may be classified as follows: (1) settling chambers, (2) low-efficiency cyclones, (3) high-efficiency cyclones, (4) cloth filters, (5) water sprays and wet collectors, (6) baffle-type collectors, (7) centrifugals, and (8) electrostatic precipitators. Figures show the ineffectiveness of settling chambers for the removal of fine dusts and for attaining high efficiencies. Settling chambers are cheaply installed and operated and may be used as preliminary separators with more efficient equipment. **II.** *Ibid.*, [4] 46–48.—Low-efficiency cyclone collectors are adapted to many dusts, especially to those of high specific gravity and dusts finer than 100 mm., although most industrial dusts are too fine to be handled satisfactorily. B.C.R.

Conversion table—millimeters to inches. *Can. Machinery's Data Sheet*, No. 37; *Can. Machinery*, **53** [4] 73 (1942). E.D.M.

Developments in ball-mill grinding practices at New Cornelia. L. M. BARKER AND E. G. LEWIS. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1361; *Mining Tech.*, **5** [5] 12 pp. (1941).—An attempt was made to test the statement that in ball-mill grinding the best efficiency is obtained when the screen analysis of the sands shows a minimum crowding at any one size. A modified two-stage grinding circuit was in use. This showed crowding with most of the material in the −28 to +65-mesh screen sizes for both mills. The size of the ball make-up was reduced from 3 to 2½ in. for the primary mill and from 2½ to 2 in. for the secondary mill. There was less crowding in both, but less tonnage was ground. All new feed was then run through one mill on open circuit and then to three secondaries. This gave little crowding in the primary mill and a decrease in the secondary mill, but the classifiers gave trouble. When the ball make-up was changed to 50% each of two sizes, there was little change. Single-stage grinding was tried, but it was not more effective until ball make-up was changed to 30% 3 in. and 70% 2 in. This was adopted as grinding practice, although optimum conditions were not obtained. W.D.F.

Economical conveyer operation. D. T. ANDERTON. *Mine & Quarry Eng.*, **6**, 277 (1941); *Trans. Brit. Ceram. Soc.*, **41** [1] 3A (1942).—The installation of wide belts is advised. Belt widths for materials of various sizes are given. The life of the belt is greatly affected by the speed at which the load is carried. Wear is reduced when a belt is run fully loaded at a low speed rather than partially loaded at a higher speed. Suitable conditions for speeds of 200 to 450 ft. per min. are tabulated. A general guide for the quality of the belt material is given. Care should be taken in selecting cover thicknesses to obtain equal life of fabric and top cover. The correct number of piles to be used is given in a table. Cleaning of the belts is advisable; one method is illustrated. Advice is given on the idler operation, and lubrication of the idlers is recommended. The importance of the tension at which a conveyer belt is operated is indicated. The effects of pulley conditions on operation are enumerated. Data on the feeding and discharging of the belt are given. The loading capacity of a troughed belt running at 100 ft. per min. is tabulated.

Hard ceramic replaces metal in nozzle inserts. ANON. *Can. Machinery*, **53** [4] 104 (1942).—An extremely hard, abrasion-resistant ceramic is used for inserts in Long-Lyfe nozzles manufactured by the American Foundry Co. The ceramic insert is claimed to be superior in hardness and density to many of the metals being used for this purpose. E.D.M.

Humidity control system in drier. ANON. *Brick & Clay Record*, **100** [3] 44, 46 (1942).—The operation of a completely automatic humidity drier is described. B.C.R.

Precision refractometer. J. V. HUGHES. *Jour. Sci. Instruments*, **18** [12] 234–37 (1941).—H. describes a refractometer capable of giving refractive indices and dispersions to one unit in the fifth decimal place. A complete determination can be made in one half hour. The instrument compares favorably with the Pulfrich refractometer, both in accuracy and in speed. G.A.K.

Vibrating feeders. GEORGE A. PAGE. *Brick & Clay Record*, **100** [3] 40, 42 (1942).—The Stockton Fire Brick Co. has replaced its disk feeders with vibrating feeders, obtaining more economical operation and improved control of feed at the pug mills, dry pans, and mixers. Arching of wet material fed to bins was overcome, thereby eliminating the labor of one man. Vibrating feeders were found unsatisfactory as proportioning devices because of the need of a constant voltage. Varying moisture content and screen sizes vary the rate of feed with a constant rheostat setting. B.C.R.

Viscometer in works practice. H. L. CROOK. *Jour. Soc. Glass Tech.*, **23**, 82–107T (1939).—A rotating cylinder viscometer was applied to plant problems, and an example is given of its use in the development of a glass of increased chemical resistance. Calculated values are given for the effect of various oxides on the viscosity of glasses into which they are introduced. C. discusses the effect of the viscosity-temperature relationship on the "setting rate" of glasses. Measurements on opal glasses are also reported. The viscometer was calibrated by reference to its physical dimensions. The results given are absolute values based on calibration.

SEPARATE PUBLICATION

Design of Air-Blast Meter and Calibrating Equipment. A. T. IRELAND. *U. S. Bur. Mines Tech. Paper*, No. 635, 20 pp. Supt. of Documents, Govt. Printing Office, Washington, D. C. Price 10¢. R.A.H.

PATENTS

Centrifugal separator. H. C. FITZSIMMONS (Sharples Corp.). U. S. 2,286,354, June 16, 1942 (Feb. 13, 1940).

Induction furnace. H. C. FISHER (Norton Co.). U. S. 2,286,355, June 16, 1942 (April 16, 1941).

U. S. 2,286,481, June 16, 1942 (July 5, 1940).—An induction furnace comprising an asbestos box, a refractory bottom in the asbestos box, a spirally wound hollow induction coil inside of the box whereby water may be circulated through the coil, a furnace wall having a passage inside of the induction coil, connections for admitting air under pressure to the passage, a lining of granular refractory material inside of the wall, and a sintered portion in the inside of the lining constituting the crucible for the furnace, the construction trapping any molten metal which penetrates the lining before it reaches the water-cooled induction coil by allowing the molten metal to flow into the passage which is cooled by the air under pressure and which thereby cools the refractory granular material to cause a steep temperature gradient between the crucible and the wall, thereby quickly to freeze any metal or slag penetrating the sintered crucible to increase the life of the lining.

Kilns, Furnaces, Fuels, and Combustion

CO_2 recorders—development, types, and use: III, Orsatomat, Bimeter, W. R., Union, and Ranerex. D. J. BRADBURY. *Ind. Power & Fuel Economist*, **16** [183] 220–22, 226 (1940). **IV, Katharometer, Cambridge, Siemens, Gordon and Lehmann, and Mono Duplex.** *Ibid.*, **17** [184] 7–9, 16 (1941). **V, Cocoo, Ados Duplex, Cambridge,**

and Siemens types for CO_2 and unburned gases. *Ibid.*, [186] 41–44.—Illustrated. For Parts I and II see *Ceram. Abs.*, **20** [2] 52 (1941). G.A.K.

Fuel economy. D. L. WILSON. *Refrac. Jour.*, **18** [3] 59, 61, 63 (1942).—In firing refractories, coal consumption varies from 2.2 to 8 cwt. per ton for fire clay with an average of 4.3, from 9 to 16 for silica, and from 3 to 9 cwt. per ton for basic materials; the variations are due to differences in kiln size, types of kiln, methods of firing, and raw materials used. More economical firing is possible through lighter firing, firing alternate boxes, eliminating excess air from leaks in kilns, and insulation; periodic kilns must be coupled in groups to obtain greatest economy. B.C.R.

Geology

Additional data on the Delesse-Rosiwal method. A. WILLIAMS POSTEL AND H. M. LUFKIN. *Amer. Mineralogist*, **27**, 335–43 (1942).—Delesse-Rosiwal modal determinations of mineral composition from rock thin sections should not be computed to an accuracy within 1% unless the rock formation subjected to investigation is known to be of uniform composition or unless modal composition is to be related to chemical composition in a given sample. When rock formations are known to have a regional variability in mineral composition, modal determinations should be made to an accuracy just within the largest known regional variation for a single mineral constituent. Statistical analysis shows that modal analyses accurate to within 10% can be obtained by taking six traverses, 15 mm. in length, across the thin section, provided the thin section is an adequate sample of the specimen from which it is made. W.D.F.

Alteration products of olivine and leucite in the leucite-lamproites from the West Kimberley area, Western Australia. REX T. PRIDER AND W. F. COLE. *Amer. Mineralogist*, **27**, 373–84 (1942).—The leucite-lamproites of the West Kimberley area are composed essentially of leucite associated with phlogopite, diopside, and magnaphorite. X-ray, optical, and chemical examinations of altered leucite phenocrysts indicate that the leucite has been replaced by an aggregate of orthoclase and an unidentified claylike mineral. Olivine has been replaced by nontronite. Such replacement has not been recorded previously. W.D.F.

Applications of modern clay research in ceramics. F. H. NORTON. *Jour. Geol.*, **50** [3] 320–30 (1942).—N. discusses modern concepts concerning the ceramic properties and nature of plastic and viscous clay-water systems. The physical characteristics are treated on the basis of an idealized air-water-clay diagram with varying water content. The drying-shrinkage properties of clay formed by dry pressing, extrusion molding, plastic molding, and casting are differentiated. The systems used in the classification of clays mineralogically, geologically, and industrially are mentioned. Chemical and physical treatment can be applied to clays to alter such variables as adsorbed electrolytes, particle size, and organic content to obtain clays with definite physical properties. S. SPEIL

Applications of modern clay research in construction engineering. HANS F. WINTERKORN. *Jour. Geol.*, **50** [3] 291–306 (1942).—Engineering applications of cohesive soil materials fall into two classes: (1) structures unaffected by seasonal or daily climatic variations, such as dams or fills; and (2) those subject to variations in moisture or temperature, such as highway subsoils. The settlement theory for the first class is based on the law of stress distribution in soils, compressibility, permeability, and shear and plastic flow properties which depend on the clay minerals and the exchangeable bases which are present. Clay research has yielded explanations for empirical relationships and led to various industrial applications. To stop water percolation through lake bottoms or fill dams, the soil can be treated with saline solution, and, after washing, it assumes the deflocculated state and low permeability characteristic of Na clay. Bentonitic injections also stop percolation because of the swelling properties of this mineral. In highway construction, moisture changes cause swelling or shrinkage and finally cracking. Temperature variations lead to large volume changes and differences in mechanical properties. Stabilization of these soils is accomplished (1) mechanically, by compacting the soil or changing the moisture content; (2) chemically, by chemical reactions; (3) physically, by particle-size grading; and (4) physicochemically, by a combination method such as the use of bitumen compounds. The ease of stabilization by bitumen is favored by a small $SiO_2:R_2O_3$ ratio, the presence of high-valence or flocculating ions such as H^+ or Al^{+++}, and the chernozem type of organic matter. S. SPEIL

Australian bauxite. ANON. *Chem. Age* [London], **45** [1171] 290 (1941).—Large deposits of bauxite occur in New South Wales which may be mined by cheap methods. They are of such good quality that a Melbourne company has applied for permission to manufacture aluminum from Australian bauxite at Port Kembla and subsequently to build a plant in Queensland to treat Mt. Tamborine bauxite. The Government will give preference to an Australian organization having a preponderance of Australian capital and not connected with the international aluminum combine. The secretary of the Aluminium Advancement Assn. has stated that more than £1,000,000 of local capital is available for the establishment of an Australian aluminum industry and that more than 30,000 tons of high-grade ore have already been mined, some analyzing 53 to 58% alumina. The Bauxite Committee estimates New South Wales deposits at 10,000,000 tons, in addition to which there are substantial deposits in Queensland. See *Ceram. Abs.*, **21** [1] 22 (1942). A.B.S.

Barytes at Pembroke, Hants County, N. S. C. O. CAMPBELL. *Trans. Can. Inst. Mining & Met.*, **45**, 299–310 (1942).—A large lenticular barytes deposit occurs in the basal beds of the Windsor series (Upper Mississippian). It is in a limestone conglomerate below a bed of gypsum and has been formed by replacement of the calcium carbonate of the conglomerate. It is mined by the open-pit method. Clean ore is taken directly to the mill. Ore containing sand, admixed manganese oxides, and mud is first washed. At the mill at Walton the ore is crushed to $-1/4$ in. and pulverized in a Raymond high-side mill to 98.5% through 325-mesh. Two shifts per day produce slightly over 100 tons. The ore is a hard, massive, gray to red material. A pure white can easily be obtained by acid leaching. It analyzes over 97% $BaSO_4$. This ore has been used chiefly as a weighting material for drilling muds in Trinidad and Peru. G.M.H.

Canadian bentonitic clays as bonding materials for synthetic molding-sand mixtures. C. H. FREEMAN. *Bull. Imperial Inst.*, **39** [4] 402–406 (1941).—F. reports on the testing of five samples of bentonitic clays as bonding material for synthetic molding-sand mixtures. G.A.K.

Deposit of chrome ore in Yugoslavia. G. PETUNNIKOV. *Montan. Rundschau*, **32**, 261–62 (1940); abstracted in *Chem. Zentr.*, **1941, I**, 2094.—A new chrome ore deposit is reported in the Lazac region on the northern slope of the Jelica Mts. Exploratory excavations showed a chromite vein 6.10 m. long, 1.66 m. high, and 0.84 m. thick. It is known that the vein goes deeper and widens out. M.V.C.

Elements of the petrographic study of bonding clays and of the clay substance of molding sands. R. E. GRIM. *Illinois State Geol. Survey Rept. Investigations*, No. 69, pp. 5–11 (1940); see *Ceram. Abs.*, **20** [1] 29 (1941). G.A.K.

Fluorspar. ANON. *Chem. Industries*, **50** [5] 674 (1942).—A brief summary of grades (metallurgical, ceramic, and acid), uses, and prices is presented. See *Ceram. Abs.*, **21** [4] 89 (1942). E.D.M.

Geological applications of nuclear physics. CLARK GOODMAN. *Jour. Applied Physics*, **13** [5] 276–89 (1942).—Nuclear physics has aided in the understanding of each of

the three major branches of geological study: (1) history, (2) structure, and (3) composition of the earth. These applications are reviewed, and possible future developments are outlined. A.P.

Industrial uses of bentonite. T. A. KLINEFELTER. *Ohio State Univ. Eng. Expt. Sta. News*, **14** [2] 14–15 (1942).—Some time ago patents were granted for the use of bentonite in refractories and refractory cements. Because of its extraordinary plasticity, more nonplastic and refractory clay can be used in the mix, thus making a better refractory. The ceramic industry has not made general use of bentonite; the patents have recently expired, however, and there may be a change. The petroleum industry is the largest user, followed by the foundry trade. W.D.F.

Lattice structure of clay minerals and some properties of clays. STERLING B. HENDRICKS. *Jour. Geol.*, **50** [3] 276–90 (1942).—Five types of lattice structure are associated with clay minerals: (1) uncharged layers with hydroxyl ions on both surfaces, (2) hydroxyl ions on one surface and oxygen ions on the other, (3) oxygen ions on both surfaces, (4) charged layers with oxygen ions on both surfaces, and (5) two types of layers, one with oxygen ions on both surfaces and one with hydroxyl ions on both surfaces. Kaolin minerals and serpentine belong to class 2, the fibrous structure of chrysotile being caused by an extension of kaolin-like plates in only one direction. Only slight isomorphic replacement is allowed in the kaolin minerals. Talc and pyrophyllite, representative of group 3, also have limited isomorphic replacement and base exchange because of their balanced structure. Hydrous micas or illites belong to class 4. The high base-exchange capacity of montmorillonites is caused partially by external compensation of electric charge to maintain neutrality when isomorphic replacements are made in the lattice structure itself. The end members of these isomorphic series are montmorillonite, beidellite, nontronite, and aluminian nontronite. Magnesium montmorillonite differs from the other montmorillonite minerals. New analytical data on the montmorillonite group are summarized and applied to the problem of base-exchange phenomena. The type of layer lattice is shown to have a definite relation to crystal size, polymorphism, and base-exchange capacity. S. SPEIL

Lithium pegmatite of Kluntarna in the Piteå Archipelago. ERLAND GRIP. *Geol. Fören. Förh.*, **62**, 380–90 (1940); abstracted in *Chem. Zentr.*, **1941, I,** 1932–33.—The pegmatite containing Li from the above deposit was tested petrographically and chemically. It contained microcline-perthite, quartz, albite, spodumene, rubellite, black tourmaline or schorl, verdelite and achroite, lepidolite, manganapatite, and rutile. The spodumene was tested optically and analyzed chemically. The indices of refraction are as follows: $\alpha = 1.653$, $\beta = 1.659$, $\gamma = 1.677$ (all ± 0.002), c: $\gamma = 25°$, $2V_\gamma = 66°$. Chemical analysis yielded the following values: SiO_2 65.05, Al_2O_3 26.70, Fe_2O_3 0.04, CaO 0.09, Li_2O 6.35, Na_2O 1.68, K_2O 0.21, and H_2O^+ 0.17%. Rb and Cs were not detected by the spectroscope. Lina granite from the same deposit was also examined. M.V.C.

Mineral composition and texture of clay substance of natural molding sands. R. E. GRIM AND C. E. SCHUBERT. *Illinois State Geol. Survey Rept. Investigations*, No. 69, pp. 12–23 (1940); see *Ceram. Abs.*, **20** [1] 29 (1941). G.A.K.

Mineral resources of the Domira Bay district, Nyasaland. W. H. REEVE. *Ann. Rept. Geol. Survey Nyasaland Protectorate*, **1940**; reprinted in *Bull. Imperial Inst.*, **39** [4] 411 (1941).—Kaolin deposits are given. G.A.K.

Modern clay researches in relation to agriculture. W. P. KELLEY. *Jour. Geol.*, **50** [3] 307–19 (1942).—Until 10 years ago, soil colloids were considered to be largely uncombined oxides in the amorphous form. The realization that soil clay was actually crystalline and consisted of three main mineral types, montmorillonite, illite, and kaolinite, has stimulated research on the origin and formation of soil. The base-exchange capacity, degree of saturation, swelling characteristics, and particle size are important in controlling and classifying soils. Arid regions are characterized by Na^+ clays which are dispersed and unsuitable for agricultural purposes. A flocculated soil, commonly Ca^{++} clay, is desirable. Very fine grain size affects drainage adversely but increases the ability of soil to adsorb nutrients. The base-exchange capacity, swelling, and ease of dispersion decrease in the order montmorillonite, illite, kaolinite. Kaolinitic clays also show limited anion exchange and thus adsorb phosphate ions. Soil science is necessarily linked with research on clay-mineral crystal structure and clay geology. S. SPEIL

Modern concepts of clay materials. RALPH GRIM. *Jour. Geol.*, **50** [3] 225–75 (1942).—The study of clays has advanced greatly with the acceptance of the concept that clays and soils are crystalline hydrous silicate minerals with varying degrees of isomorphic replacement. The physical properties of these clays are controlled mainly by the amount and particle-size distribution of the clay and nonclay minerals, the organic content, and the type and amount of electrolyte. G. discusses thoroughly the structure of the major mineral types, montmorillonites, illites, and kaolins, as well as some of the minor classes, such as halloysite and attapulgite. Degree of dispersion, specific surface area, swelling characteristics, and base-exchange capacity increase in the order kaolinite, illite, montmorillonite. The cause of the base-exchange properties is different for each mineral type; the base exchange of montmorillonite does not vary with the particle size, while the other minerals show an increase in capacity with decreasing size. The relative ease of cation replacement is also different for each mineral type. The soil-forming processes usually result in kaolins or montmorillonites, while illites and kaolins predominate in marine sediments. The water adsorbed on clay particles is either planar (montmorillonite) or broken-bond water (kaolinite). The change of plasticity with ionic type can be considered to be due to the different binding action of the cations. This viewpoint may be used to explain variations in strength, porosity, yield point, plasticity, and swelling. S. SPEIL

Purification of Indian glass sands. B. J. HEGDE. *Bull. Indian Ind. Research*, No. 22 (1941); abstracted in *Bull. Imperial Inst.*, **39** [4] 420–21 (1941). G.A.K.

Relationship between the physical and mineralogical characteristics of bonding clays. R. E. GRIM AND R. A. ROWLAND. *Illinois State Geol. Survey Rept. Investigations*, No. 69, pp. 24–32 (1940); *Trans. Amer. Foundrymen's Assn.*, **48,** 211–24 (1940).—Data show that the kind and the amount of clay mineral in a clay are the most important factors determining its bonding strength. The relation between these factors is discussed. The problem of the break-up of the clay mineral in clays, such as that which might be brought about by mulling, is analyzed in relation to bonding strength. G.A.K.

Sources of magnesia and magnesium in Canada. M. F. GOUDGE. *Trans. Can. Inst. Mining & Met.*, **45,** 191–207 (1942).—The war has aroused great interest in magnesia and magnesium, both of which are essential war commodities, and numerous processes are being developed to recover these materials from their natural sources. These processes, coupled with the abundance of raw materials, have largely eliminated geographic limitations formerly imposed by dependence on either magnesite or brine as the sole sources of magnesia and magnesium. For many years a magnesitic dolomite in Argenteuil County, Quebec, has supplied part of the Canadian requirements for basic refractories. The products from these deposits are excellent for many uses, but the silica and lime contents are too high to permit their use in nickel converters and in the roofs of reverberatory furnaces used in the copper and steel industries. Austrian, Manchurian, and Philippine sources are now closed to Canada, and U. S. sources will experience a growing difficulty in supplying Canadian requirements. To obviate the danger of a serious shortage, a plant is being built near Wakefield, Quebec, to produce pure granular magnesia from brucitic limestone, mainly for use in making refractory brick. A plant is also being built at Haley's, Ontario, to produce magnesium metal from calcined dolomite by direct reduction with ferro-

silicon. G. discusses processes for the production of magnesia and magnesium and briefly describes Canadian sources of raw materials. There are undeveloped deposits of magnesite in British Columbia, particularly at Marysville. Several hydromagnesite deposits also are known in that province. Because of the difficulty of calcining without excessive dust losses, these deposits are of little current commercial interest. A process for the recovery of magnesium chloride from serpentine, which occurs in quantity in three provinces, is being studied. Olivine, which occurs in British Columbia and Quebec, offers another possibility. Dolomites are widespread throughout the eastern half of Canada and in parts of western Canada. G. also discusses epsomite, brines and bitterns, and sea water as source materials. See "American . . .," *Ceram. Abs.*, **21** [2] 42 (1942); "New Canadian . . .," *ibid.*, p. 48. G.M.H.

Thermal studies of orthoclase and microcline. JOSEPH L. ROSENHOLTZ AND DUDLEY T. SMITH. *Amer. Mineralogist*, **27**, 344–49 (1942).—Microcline from Bedford, N. Y., was used. Its composition is $Or_{84}Ab_{16}$. Mean values for the coefficient of linear expansion parallel to *a* increase from 14.97 to 17.85 $\times 10^{-6}$ at 1000°C. Mean values parallel to *b* drop to -0.04×10^{-6} at 500°C. and then increase to 1.18×10^{-6} at 1000°C. Mean values parallel to *c* increase from 0.49 to 1.30 $\times 10^{-6}$ at 1000°C. Twenty abrupt volume changes were found. Orthoclase from Good Springs, Nevada, was used. Its composition is $Or_{72}Ab_{24}An_3$. As the crystals were found to be slightly altered, the thermal expansion is not given. Eleven abrupt volume changes were found. Microcline, orthoclase, and adularia are compared. W.D.F.

SEPARATE PUBLICATIONS

Cinnabar-Reduction Plants of the Southwestern Arkansas Quicksilver District. Metallurgical Division Progress Report No. 51. S. M. SHELTON AND W. A. CALHOUN. *U. S. Bur. Mines Repts. Investigations*, No. 3627, 24 pp. Free. R.A.H.

Industrial Waters of Canada. HARALD A. LEVERIN. *Can. Dept. Mines, Bur. Mines, Mines & Geol. Branch, Dept. Mines & Resources, Pub.*, No. 807 (1942). 112 pp., 6 tables, 4 figs. Price, paper, 25¢.—L. discusses methods of making and recording water analyses, impurities and their effect in various industries, methods of purification, and the character of Canadian waters. Hardness maps are included in the report. In all, 800 samples of surface waters and civic waters were analyzed. G.M.H.

Magnetic Separation of Ores. R. S. DEAN AND C. W. DAVIS. *U. S. Bur. Mines Bull.*, No. 425, 417 pp. Supt. of Documents, Govt. Printing Office, Washington, D. C. Price $1.00.—The authors discuss operations and trends in magnetic separation and describe and classify the machines used. R.A.H.

Manganese Investigations—Metallurgical Division: 7, Hydrometallurgical studies of manganese ores. Nitrogen dioxide process for recovery of manganese from ores. R. S. DEAN, A. L. FOX, AND A. E. BECK. *U. S. Bur. Mines Repts. Investigations*, No. 3626, 30 pp. **8, Pyrometallurgical studies of manganese ores. Sintering or nodulizing of ferrograde manganese mill products and fine ores for smelting purposes.** VIRGIL MILLER, F. B. PETERMAN, J. A. PIKE, AND R. G. PETERSON. *Ibid.*, No. 3625, 14 pp. **9, Concentration of manganiferous-iron ore from Armour No. 1 mine, Ironton, Minn.** M. M. FINE, S. M. SHELTON, AND J. B. ZADRA. *Ibid.*, No. 3624, 13 pp. **10, Ore-dressing studies of manganese ores. Concentration of manganese-bearing ore from Interstate Manganese Co., Johnson County, Tenn.** T. L. JOHNSON, S. M. SHELTON, M. M. FINE, AND W. A. CALHOUN. *Ibid.*, No. 3623, 13 pp. Free. R.A.H.

Marketing Silica (Quartz, Tripoli, Diatomite, etc.). NAN JENSEN. *U. S. Bur. Mines Information Circ.*, No. 7202, 39 pp. Free.—J. discusses the various forms of silica and its occurrence, properties, uses, production, and prices. A bibliography and lists of buyers of silica are included. R.A.H.

Ore-Testing Studies of the Ore-Dressing Section, Fiscal Year 1941. Metallurgical Division Progress Report No. 52. A. L. ENGEL AND S. M. SHELTON. *U. S. Bur. Mines Repts. Investigations*, No. 3628, 36 pp. Free.—Results are given of tests on manganese, carnotite, vanadinite, and descloizite, mercury (cinnabar), lead, iron, strontium, titantium (rutile), and magnesite ores, zinc shats, and jig concentrates during the fiscal year 1941. R.A.H.

Paleozoic and Related Rocks of Southeastern Minnesota. C. R. STAUFFER AND G. A. THIEL. *Minnesota Geol. Survey Bull.*, No. 29, 261 pp. (1941).—The stratigraphy of Minnesota south and east of Morrison County is studied. The location and compositions of limestones are given, and over 100 pages of sections and well records and a faunal list are included. B.L.

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Mineral piercing and cutting. R. B. AITCHISON, C. J. BURCH, AND C. W. SWARTOUT (Linde Air Products Co.). U. S. 2,286,191, June 16, 1942 (April 18, 1939). R. B. AITCHISON, G. H. SMITH, AND C. W. SWARTOUT (Linde Air Products Co.). U. S. 2,286,192, June 16, 1942 (April 18, 1939).

Springing holes in minerals and mineral-like materials. R. B. AITCHISON (Linde Air Products Co.). U. S. 2,286,782, June 16, 1942 (April 2, 1941).

Treatment of zircon sand. M. O. AXT AND F. W. BERK & Co., LTD. Brit. 544,965, May 20, 1942 (Feb. 24, 1941).

Chemistry and Physics

Application of statistical evaluation methods based on the law of large numbers as research methods in industry. E. FRANKE. *Messtechnik*, **16** [8] 113–16 (1940); abstracted in *Physik. Ber.*, **22** [4] 352–53 (1941).—E. discusses the advantages of statistical methods in the determination of certain characteristics of materials, the operation and accuracy of machines in finishing and testing, calculation of the cost of industrial processes, and the influence of the human factor. M.H.

Confirmation of the theory of thermal diffusion. T. I. TAYLOR AND G. GLOCKLER. *Jour. Chem. Phys.*, **8** [10] 843–44 (1940). G.A.K.

Determination of lead in silicate rocks. IVAN T. ROSENQVIST. *Amer. Jour. Sci.*, **240** [5] 356–63 (1942).—The lead content of some Norwegian silicate rocks was determined. An enrichment of the lead was accomplished by coprecipitation as sulfate using strontium as a carrier. The lead was determined electrolytically as lead dioxide in the enriched product. The efficiency of the various operations was controlled by the use of thorium B as radioactive indicator. The superiority of strontium over carriers used in other methods is shown. The proportion of lead in the rocks studied was fairly constant in spite of different origins and some variations in composition. B.C.R.

Electric-furnace study of the MgO–SiO_2 system. ROBERT R. RALSTON AND GEORGE T. FAUST. *Jour. Amer. Ceram. Soc.*, **25** [11] 294–310 (July, 1942).—12 references, 14 figures.

Rapid determination of potassium in Portland cement. WALKER L. HONAKER. *Concrete, Cement Mill Ed.*, **50**, 153–54 (1942).—This method was adopted because of its speed, low cost, simplicity, and close agreement with established methods. The alkalis are separated from the silicates by evaporation with hydrochloric acid, which is then completely volatilized. The residue is dissolved in dilute acetic acid, and the silica and ferric acetate are filtered off. Potassium is precipitated at room temperature by sodium cobaltinitrite. A centrifuge is employed to separate the precipitate of potassium sodium cobaltinitrite. Excess standard ceric sulfate and sulfuric acid are added to dissolve the precipitate. The excess ceric sulfate

is titrated with standard ferrous ammonium sulfate, *o*-phenanthroline-ferrous complex being used as indicator. W.D.F.

Short table of quantities used in computations for cubic space lattices. L. W. McKeehan. *Jour. Chem. Phys.*, **8** [7] 567–68 (1940). G.A.K.

Simple method of finding Poisson's ratio. Mary D. Waller. *Proc. Phys. Soc.* [London], **52**, 710–13 (1940).—W. describes a method by which Poisson's ratio can be measured in terms of the ratio of two specified natural frequencies of a free vibrating square plate. Results are given for glass, steel, brass, copper, and aluminum. Such a simple method of estimating this elastic constant might be of value in the mechanical testing of metals and alloys. L.E.T.

Spectrochemical method for the determination of boron in synthetic mixtures of soil materials. R. Q. Parks. *Jour. Optical Soc. Amer.*, **32** [4] 233–37 (1942).—A 50-mgm. sample of each soil material was mixed with 100 mgm. of $CaCO_3$ as buffer and 1 cc. 0.03% stannous chloride or iodide as internal standard. Three or four 30-sec. exposures with a 2200-volt a.-c. arc were used for each sample. Three standards identical in composition except for known variations in boron content were arced in the same manner for each sample. Working curves plotted boron contents of the standards against the ratios of the intensities of the 2497.7 a.u. boron line and the 2429.5 a.u. tin line. Boron contents could be determined with standard deviations of 3 to 10% for single determinations. A.P.

Study of the system P_2O_5–Fe_2O_3 in the ultraviolet reflection spectrum. A. Berton and P. Brasseur. *Compt. Rend.*, **211** [13] 258–60 (1940).—Powdered samples of these minerals, obtained by evaporation and subsequent calcination at 800°C., were mixed in various proportions. The phosphoric anhydride reflects all ultraviolet radiation (from 4000 to 2400 a.u.). The absorption of ultraviolet radiation in mixtures increases with increase in the Fe_2O_3 content, passes through a maximum for the composition corresponding to the pyrophosphate, and then diminishes again. All measurements confirmed the existence of ferric metaphosphate, pyrophosphate, and orthophosphate and of the basic phosphate $P_2O_5{\cdot}2Fe_2O_3$. The method using the ultraviolet reflection spectrum is considered useful and convenient for the study of solid systems, especially where the absorption by the components is intense and characteristic (distinct for different wave lengths); an approximate determination can be made in 5 to 30 sec. M.H.

Theory of fusion. J. G. Kirkwood and E. Monroe. *Jour. Chem. Phys.*, **8** [10] 845–46 (1940).—A brief outline of a theory of fusion based upon the concept of an order-disorder transformation is given. G.A.K.

Theory of the thermodynamic properties of large molecules. R. E. Powell, C. R. Clark, and H. Eyring. *Jour. Chem. Phys.*, **9** [3] 268–73 (1941).—The following thermodynamic properties are explained by the Kauzmann and Eyring theory of the motion of segments: (*a*) change of melting temperature with chain length, (*b*) abnormally large increase in the osmotic pressures of large linear polymers with concentration, (*c*) abnormally large vapor pressure of solvent above concentrated solutions of such polymers, (*d*) the fact that surface tension becomes independent of the molecular weight for long molecules, and (*e*) volume and entropy changes of swelling of polymers. The theory for the effect of the concentration of the solvent is developed, and segment lengths are calculated. All effects indicate segments of the order of 20 atoms in length, the length varying with the nature of the polymer. G.A.K.

X-ray absorption structure as a tool in physics and chemistry. S. T. Stephenson. *Jour. Applied Physics*, **13** [3] 142–46 (1942).—With the assumption that X-ray absorption fine structure is caused by an electron-scattering process, a powerful research tool for investigating certain problems in physics and chemistry is made available. S. outlines its application in the determination of (1) arrangement of the component parts of a molecule in a gas, (2) size and shape of molecules or ions in a solution, (3) degree of ionic dissociation in a solution, (4) structure of liquids and fused salts, (5) energy zones of metals and alloys, and (6) placing of molecules of water of crystallization. 29 references. A.P.

X-ray investigation of the reduction products of titanium dioxide. E. Belyakova, A. Komar, and V. Mikhailov. *Metallurg*, **14** [4–5] 23–25 (1939); abstracted in *Physik. Ber.*, **22** [4] 404–405 (1941).—When TiO_2 is reduced in H_2, Ti_2O_3[11] is formed at 1200° to 1500°C. The presence of TiO can be detected only at 1500° in small quantities. The reduction of TiO_2 by C in a CO atmosphere gives a product with cube face-centered lattice, the parameter of which increases with increasing reduction temperature (1100° to 1600°C.). The reduction product consists of solid solutions of TiC and TiO, and, with increasing reduction temperature, increasing amounts of TiC are found. See *Ceram. Abs.*, **20** [1] 33 (1941). M.H.

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Diffusion in and through Solids. R. M. Barrer. Cambridge Univ. Press, London; Macmillan Co., New York, 1941. 464 + xiii pp., 158 figs. Price $6.50. Reviewed in *Jour. Applied Physics*, **13** [3] 156 (1942). A.P.

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Preparation of titanium dioxide pigments. Jelks Barksdale and W. W. Plechner (National Lead Co.). U. S. 2,285,486, June 9, 1942 (June 18, 1940).

Production of titanium dioxide. Jelks Barksdale and W. W. Plechner (National Lead Co.). U. S. 2,285,485, June 9, 1942 (Nov. 3, 1938).

General

Architect cites protection in blast walls—London planning glass in rebuilding. Anon. *Amer. Glass Rev.*, **61** [28] 9, 12 (1942).—According to C. Howard Crane, London architect, London will rebuild with the modern skeleton frame and great windowed areas, including special glasses to reduce glare and absorb sun heat. Few windowless industrial plants are being built, because they require too much metal for air ducts, fans, and other mechanical equipment. Instead, new and old buildings are being equipped with blast walls, usually 14 in. of reinforced brickwork built 8 ft. high, to enclose every 10,000 sq. ft. of working area. Solid roof construction has been replaced by a thin asbestos material clipped to a steel framework. Bomb explosions rip the asbestos away but usually leave the steel framework intact. A.P.

Biochemistry of silicic acid: IX, Isolation and identification of minerals in lung residues and air-borne dusts from coal mines. G. Nagelschmidt and E. J. King. *Biochem. Jour.*, **35**, 152 (1941); *Trans. Brit. Ceram. Soc.*, **41** [1] 13A (1942).—As most of the mineral particles found in silicotic lungs are below 5 μ in diameter, microscopic identification is uncertain; X-ray methods have therefore been adopted. The following methods of preparing lung residue are considered: (1) simple drying after formalin hardening, (2) destruction of organic matter by digestion with acid or by enzyme treatment, and (3) removal of organic matter by H_2O_2. The third method was considered most suitable and was carried out in three stages; fatty material was first removed from powdered oven-dry lung with acetone, and the residue was then digested with H_2O_2 and extracted by acid or buffer solution. Chemical and X-ray diffraction data are presented for a lung residue and a mine dust. The three main constituents of a silicotic lung were identified as quartz, one of the kaolin minerals, and a mineral of the mica family; it is considered that less than half of the total silica shown by chemical analysis or less than a quarter of the mineral residue is present as free quartz.

Boiler compounds and boiler-water conditioning. BENJAMIN LEVITT. *Chem. Industries*, **50** [5] 656–58 (1942).—Boiler-water treatment is discussed under the following headings: (1) temporary and permanent hardness, (2) pretreatment of the raw water before it reaches the boiler, and (3) internal treatment (with soda ash, sodium aluminate, phosphates, etc.). Corrosion due to dissolved oxygen in the water may be prevented almost entirely by deaerators and heaters, but for complete elimination of the remaining oxygen, sodium sulfite or a ferrous salt may be employed. Chromates, nitrates, acetates, and tannin extracts are listed as inhibitors. Starch and colloidal graphite are used to make the scale flaky and less adherent. Boiler compounds are generally made to suit each set of special conditions. The application of ion exchange synthetic resins is briefly discussed, and the basic patents are listed. 5 references. E.D.M.

Determining boiler efficiency. W. F. SCHAPHORST. *Amer. Gas Jour.*, **156** [5] 37–38 (1942). G.A.K.

Humm-Wadsworth temperament scale. F. E. POOLE. *Ind. Med.*, **11** [6] 260–63 (1942).—Since 1937, 300,000 applicants for work at the Lockheed-Vega airplane plant have been tested for personality factors and for their ability to cooperate with other workers and with their leaders or supervisors. Before the test was initiated, two out of every three new employees were unsatisfactory or were quitting. No man or woman worker, even in executive departments, is now employed without taking the test. The company's reliance upon the guidance value of the test has grown steadily. Almost every time an applicant has been employed in spite of adverse test results, it has been regretted. The test consists of 318 questions, to be answered by "yes" or "no," aiming to discover motives or traits relating to self-control, self-interest, emotion, imagination, and inspiration. Personality inquiries ascertain the applicant's skill, intelligence, personal appearance, and stature; the temperament test includes his habitual reactions to his surroundings. K.R.

Lead exposures in the printing industry in Virginia. R. T. HOMEWOOD AND H. J. WORSHEM. *Ind. Med.*, **11** [4] 186–88 (1942).—The concentration of atmospheric lead in 16 job-printing plants and 9 daily newspaper establishments in Virginia was determined to evaluate the potential lead hazard and to present recommendations for needed control. Atmospheric concentrations of lead were generally within allowable limits in the linotype, monotype, composition, and press departments. In drossing and sieving operations, concentrations as high as 955 mgm. per 10 cu. m. were found. The concentrations were worse in the newspaper plants than in the job-printing plants because of the larger amount of metal used. Urinary excretions of lead by workers engaged in these operations showed values of unusual exposure to lead. On the basis of the findings, control measures to reduce the high exposure quotas were submitted to plant officials. K.R.

Maintenance of health in chemical industries. HENRY F. SMYTH, JR. *Chem. Industries*, **50** [4] 514–16 (1942).—The hazards associated with various types of chemicals and certain precautions to be observed in their use are discussed generally under the following headings: (1) cumulative poisons, e.g., lead and radium, (2) primary irritants (acids, alkalis, etc.), (3) sensitizers and allergy, and (4) vapor and dust inhalation. E.D.M.

Occupational and compensable disease. L. BRAHDY. *Ind. Med.*, **11** [4] 147–50 (1942).—With the exception of Mississippi, all of the states and territories of the U. S. have compensation laws for mishaps in industry, but no two of these laws are identical in their coverage or application. In no place are all workers within the scope of such laws; most states exclude farm labor and domestic help from their benefits. B. discusses the basic principles of compensation as exhibited in the laws of prominent groups of states and prevailing interpretations of occupational disease in relation to occupational injury. The question of whether or not injury is occupational in origin is always medical; the compensability of an injury is always a legal question, dependent on the given state law. Silicosis is a specifically compensable disease in Idaho, Maryland, Michigan, North Carolina, Pennsylvania, Utah, and Washington. In West Virginia and Kentucky, an employer may elect to have his employees covered for silicosis. In this group of states, in a group of 8 states with blanket coverage, and in Massachusetts, tuberculosis is compensable if secondary to and caused by silicosis. K.R.

Poisonous chemicals used in painting porcelain and glass. E. WAGNER. *Sprechsaal*, **73** [52] 480–81 (1940).—Many chemicals used in painting porcelain and glass are poisonous; some act immediately and others are cumulative. They act on various parts of the body. Arsenic may cause, among other disturbances, gastrointestinal troubles and pernicious anemia. Lead poisoning is cumulative; it is absorbed more rapidly when the stomach is empty. The salts of chromium are especially harmful in the form of vapor. Manganese compounds act on the brain and spinal column, and there is small chance of cure. Mercury poisoning causes vomiting, fever, sleeplessness, and trembling. Cobalt is cumulative and likewise causes vomiting, as do cadmium salts. Inorganic acids act on the lime of the teeth. In all cases it is better and cheaper to combat diseases with rubber gloves, goggles, masks, etc., than to let them become chronic. W.H.H.

Production—ceramics' big role. ANON. *Business Week*, No. 661, p. 66 (May 2, 1942).—Ceramic substitutes for plastics, aluminum, alloy steels, nickel, copper, zinc, rubber, and other critical materials now under exclusive WPB control are discussed. In the emergency, modern ceramic technology is producing high-strength porcelains, vitreous china, porcelain enamels, stoneware, etc. A typical piece of industrial whiteware will last longer than any other ordinary substance except rubber automobile tire-tread stock and manganese steel. Specially compounded ceramic sandblast nozzles outwear even those of manganese steel. Hard vitreous tile used for lining coke chutes outlasts both steel and rubber. In chemical resistance, ceramic products withstand almost any compound except hydrofluoric acid. They are harder than most plastics, hard rubber, and common nonferrous metals and are softer than certain alloy steels and chilled cast iron, having about the same hardness as glass. Dimensional tolerances for ceramic parts used in mass-production assemblies cause difficulties of shrinkage and warpage due to firing; four methods of counteracting these inaccuracies are briefly described. Ceramic products have no size limitations; they range from the tiny porcelain beads threaded on X-ray wires as insulators up to almost gigantic stoneware, chemical processing tanks, and sewer pipe. The ceramic industry has filled or is still working on substantial contracts for military supplies. The porcelain enameling industry has delivered a large volume of enameled-steel hospital ware, kitchenware, and table tops and is now working on porcelain enameled mufflers, chairs, and lockers for Navy use. The whiteware group has supplied the War Department with vitrified dinnerware, steatite electrical instrument parts, porcelain knobs, tubes, and outlet boxes for cantonment wiring and is now developing all-clay service sinks and grease traps. Civilian industries are using wood and glass substitutes. Ceramic tile is about to replace rubber as a liner in chemical processes and storage tanks. Full use of ceramic replacements may, however, be interfered with by the lack of kilns. Tunnel kilns are needed for annealing 10,000 tons per day of armor-piercing steel stock. Although 200 tons per day per kiln would require 50 kilns, a considerable number would still be left for comprehensive ceramic use. K.R.

Report of Committee on Dust Hazard (Air Hygiene), American Ceramic Society. F. C. FLINT, *Chairman*. *Bull. Amer. Ceram. Soc.*, **21** [6] 105 (1942).

Report of Committee on Patents, American Ceramic Society. FULTON B. FLICK, *Chairman*. *Bull. Amer. Ceram. Soc.*, **21** [6] 105–107 (1942).

Report of Committee on Research, American Ceramic Society. A. A. WELLS, *Chairman*. *Bull. Amer. Ceram. Soc.*, **21** [6] 92–101 (1942).

Report of Committee on Standards, American Ceramic Society. J. W. WHITTEMORE, *Chairman*. *Bull. Amer. Ceram. Soc.*, **21** [6] 101–105 (1942).—2 references.

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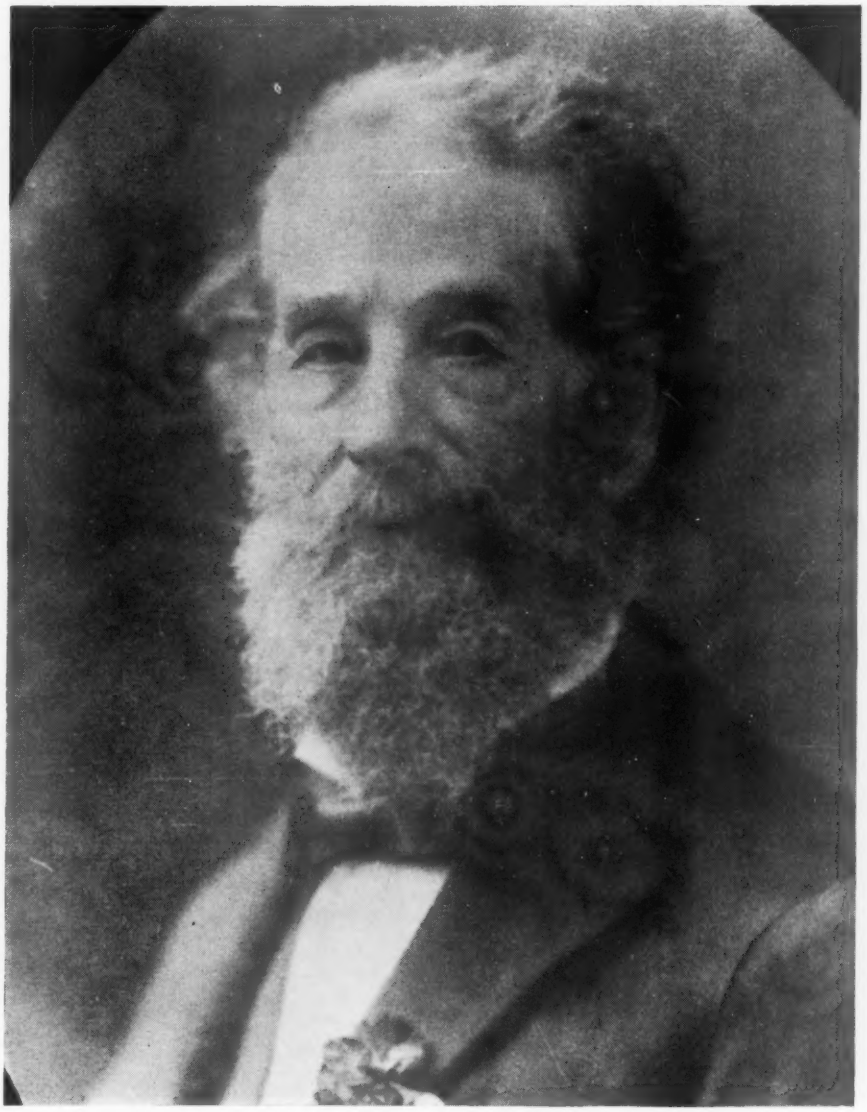


ISAAC WATTS KNOWLES, 1819–1902

ISAAC WATTS KNOWLES

By Lucille T. Cox

Isaac Watts Knowles, a potter of national renown, gave to the American ceramic industry a record of achievements, disappointments, triumphs, and discouragements unequalled in the annals of American pottery.

He came to East Liverpool, Ohio, as a skillful carpenter during the 1830's. Why his family chose the desolate river hamlet as their future home is not known, as there were no opportunities for a young cabinetmaker. Building was at a standstill, and money was so scarce that there were few silver coins to be found among the populace. Even the advent of James Bennett and his pottery in 1839 gave little impetus to prosperity. The majority of the people were skeptical of a man who dug clay from the surrounding hills and made jugs in a small clapboard shack on the river's edge. They did not believe that there was a future in this type of endeavor.

Young Knowles was keenly interested in the mysterious workings of the Bennett Pottery.[1] He spent hours watching the Englishman's skillful fingers throwing and shaping the clay and listening with rapt attention as the potter regaled him with stories of the "ould countree" and the potteries of Staffordshire. Raw clay being turned into objects of usefulness and beauty through the medium of fire and glaze was a constant source of marvel to him. During those visits to the town's first pottery, an interest and love for pottery making was born in Isaac Knowles. He was destined never to lose that interest as long as he lived.

In the meantime, however, he had a livelihood to earn in a sleepy little village that seemed almost impossible. One day he met James Bennett as the latter was attempting to cross the muddy main street of the village.

"Good morning, Mr. Bennett. If you bake those boots you have on you might sell them along with the rest of the mugs," he called jokingly.

The Englishman paused in the middle of the miry street and lifted one mud-incrusted boot to scrutinize it ruefully.

"Aye," he replied with a good-natured smile, "there's enough clay on that boot to make a sight o' jugs. But then I would have to be findin' a place to market them, an' that's sumthing I canna be doin'."

Knowles waited uutil the potter reached the board walk before he answered. His young face was serious.

"I'm thinking of building a flatboat and making a store out of it," he said slowly. "Then I'll go down the river and try to sell my goods among the farmers. I was calculating I might take a load of your dishes, providing you're willing."

As a result of this conversation, the carpenter-merchant a few weeks later loaded his boat with ware made in East Liverpool's pioneer pottery and started down the Ohio River, the first pottery salesman in the history of the town.

Many troubles and tribulations followed in the wake of the young merchant. It was the era of "wild-cat money," and, after spending the entire summer drifting down the Ohio and Mississippi rivers, he found himself in New Orleans early in the autumn with just enough good money to pay Mr. Bennett for his share of the enterprise. It was literally true that he did not have one cent to show for his work. His pockets were empty, and he was stranded in a strange town. In spite of the fact that he needed money for food and lodging, he refused to touch Mr. Bennett's silver coins which he carried in a moneybelt about his waist. One afternoon, he met a lifelong friend of his family who was master of the packet *New York*, who permitted him to work his passage back up the rivers to East Liverpool.

That was Isaac Knowles' first contact with the pottery industry. Through the next thirteen years, as he struggled to earn a living by making blungers and equipment for the potteries and by building an occasional house or creating new furniture, he never lost sight of the possibilities to be found in pottery making. Finally, in 1853, he made a decision which changed his entire life. He turned his dream of creating pottery into a reality.

The little town in which he lived was bankrupt. The years following the erection of the first pottery by James Bennett had been increasingly difficult. True, other potteries had been established during the ensuing years, but the great flood of 1852 had wrecked several of them almost beyond repair. Some potteries, including the old plant of James Bennett's, were wrecked completely. The town's first potter had moved his endeavors to Pittsburgh several years before the flood. It seems almost allegorical that Isaac Knowles should purchase the lumber of the wrecked Bennett Pottery to use in the erection of his factory.

The first shop of Isaac Knowles and his partner, Isaac Harvey, was as primitive as any in the previous decade. It was located north of the town, on top of a plateau near Tanyard Run. The one kiln was used alternately for bisque and glost firing. The two men worked long hours at the bench or in the kiln shed. They hired a few workers after a time, but whenever a kiln was to be loaded or drawn, Isaac Knowles was there to do it, sometimes unassisted.

Throughout the hard years of the Black Fifties and the Civil War, the little plant struggled for existence. Rockingham fruit jars, pie plates, bowls, and teapots were produced. Every sale was important; all the material had to be accounted for, even the brick used in facing the kiln openings. Nothing was wasted, because every penny had to be used to the best advantage if the little pottery was to survive.

The struggle was heartbreaking and would have ruined a less intrepid man than Isaac Knowles. He now carried the burden alone, as he and his partner had dissolved their partnership. During the troublesome years following the Civil War, the potter was at times beset with fears that he might fail. Every avenue of assistance seemed closed to him. Drastic changes were taking place in the pottery business. The days of uncertain capital and primitive equipment were gone.

[1] For an account of the Bennett Pottery and photographs of the Pottery and of James Bennett, see *Bull. Amer. Ceram. Soc.*, **16** [1] 27–28, 30 (1937) (story of William H. Bloor).

He was faced with the fact that his pottery must be changed to meet the demanding needs for whiteware, and he had no money for new equipment or additional buildings. The black cloud of discouragement settled over him, and he firmly believed that he had reached the end of his career as a potter.

One night, unable to sleep, the man left his home and went to his factory. He did not go inside, but stood in the bright moonlight and surveyed the dark buildings. The fire pots around the bisque kiln burned red. Their rays formed the only artificial light in the immediate neighborhood. Abruptly he sat down on a nearby log and buried his face in his hands. Failure seemed inevitable. How long he sat there he did not know, but a light touch on his shoulder aroused him. Looking up, he saw his friend, N. U. Walker, the owner of the most successful brickyards in the Ohio Valley.

"What are you doing out this hour of the night?" he said, trying to be nonchalant.

"Move over, Ike, I want to sit down beside you," replied his friend. The potter moved over.

"Ike," Mr. Walker began, without embarrassing preliminaries, "I couldn't sleep tonight. I had the feeling something was wrong with you, so I hitched up old Betsy and drove into town. I went to your house, but all was dark and I came on over here. I was just about to call myself an idiot and go home when I saw you sitting on this log. Ike, do you need money?"

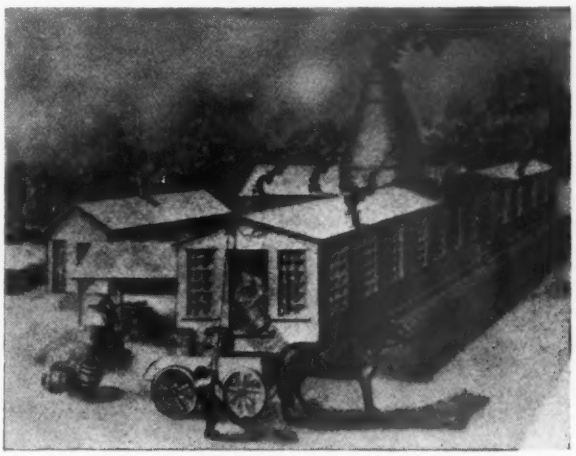
"If we are to stay in the pottery businesss, we've got to change from Rockingham to whiteware," answered Mr. Knowles. "That will cost a heap of money. I do not have it," he finished succinctly.

Rockingham artware of the pre-Civil War period. This type of ware produced in the first Knowles Pottery shows excellent workmanship and has not crazed. The originals are in the East Liverpool Historical Society Collection.

Mr. Walker placed his arm about the potter's shoulders in a gesture of deep affection. "Ike," he said, "everything and anything I have in this world that can be converted into money is yours for the asking."

History does not tell if Mr. Knowles availed himself of his friend's generous offer, but his rise to fame in the industrial world during the next two decades more than justified Mr. Walker's faith in his abilities. It was the turning point in his career as a pottery manufacturer.

Making pottery during the early difficult years was not Isaac Knowles' only achievement. His obsession for good workmanship and his early training as a master carpenter opened new fields in ceramic manufacturing as yet unrealized by other potters. He knew the time would soon be at hand when the centuries-old methods of making pottery by throwing and pressing would be inadequate to meet the demands. His inventive mind jumped ahead and met these possibilities. Consequently, he became the first man to introduce successfully machinery into ceramics.



The first pottery of Isaac Knowles in East Liverpool built in 1853 (picture made from pen print).

In October, 1870, he turned inventor and succeeded in perfecting a shaft-driven jigger, the forerunner of all mechanized aids used in pottery making. Mr. Knowles outfitted his Old End clay shop with the jiggers, which proved their worth to such an extent that before long the other plants were clamoring for reproductions. The invention was fully covered by patent, and Mr. Knowles generously permitted his competitors to profit by his new machine. The original patent papers are in the possession of his son, Edwin M. Knowles, of East Liverpool, Ohio.

Bit by bit, the indomitable potter was paving the way for the manufacture of whiteware, a step he knew must surely come. In September, 1872, the new firm of Knowles, Taylor & Knowles Company drew its first kiln of whiteware.[2] It was ironstone china and of a good grade. Isaac Knowles and his newly acquired partners, Colonel John N. Taylor and Homer S. Knowles, were content with nothing less than the best ware they could produce. The early efforts of this pottery reflect that characteristic to a high degree.

The little pottery had two kilns. The equipment, with the exception of the pulldown jiggers, was primitive, and the new ware taxed the production capacity to the limit. Strange problems were encountered which they did not know how to solve. Clays for ironstone china had to be brought into the village from outside sources. The blossom clays native to the Ohio Valley hills and used in Rockingham and yellowware no longer sufficed. More machinery, quicker and more efficient methods of making ware, and a scientific knowledge of pottery making were needed. The potters could not quite understand why they could proceed

[2] See Memories of Henry Goodwin; History of the Upper Ohio Valley, 1891; History of Columbiana County, 1905.

just so far in their new endeavors and no farther. Lack of information barred the way. Science was their need, and where, in the 1870's, could a ceramic scientist be found?

The first man to recognize the need of a test tube in pottery making was Homer Knowles, the dynamic and brilliant young junior partner of the firm. He had grown up in the atmosphere of the "potbank," working with his father in the small, yellowware plant. When he became a man, it seemed natural for him to become associated with his father in the business. He chose to sell, and during those early years amazed his father by his sagacity and courage. The road of a traveling salesman was a rocky one, but the young representative accomplished results.

One evening, Isaac Knowles and his family were finishing their dinner when the father leaned back in his chair and eyed his oldest son quizzically.

"Homer, I saw a book on chemistry in your bedroom this morning. You aren't planning on becoming a chemist and pulling out of the pottery business?" he asked jocularly, but with a hidden note of uneasiness in his voice.

The younger man's expression was slightly sheepish as he replied, "Not likely, father, but I believe there is a distinct need of chemistry in pottery making."

"Progressive, heh?" retorted his father. "Don't waste your time, lad, on such foolishness. How could books, written by people who never saw the inside of a pottery, tell you how to improve our established way of making dishes? The pottery industry will always be what it is today."

"Is that what you thought, sir," Homer asked curiously, "when you invented the pulldown jigger and started making whiteware?"

"Nonsense!" Isaac Knowles rose hastily to his feet. "Your travels haven't improved your manners!"

At the door of the dining room he stopped and glanced back at his family grouped about the table. Homer's grin was reflected on their faces.

"Go ahead with your experiments," he growled, "and let me know if you need extra money."

During the next few years, Homer Knowles acquired a chemistry library. He studied on trains, in hotel rooms, at home, and in his office at the pottery. He made tentative experiments. Most of them he discarded; others he retained for the day when he could produce real American china.

In 1880, the Knowles, Taylor & Knowles Company needed a larger plant. The firm's five-kiln factory was taxed beyond its normal capacity. The backlog of orders was piling up. Production was stretched to a breaking point. Isaac Knowles and his partners knew the time had come when something had to be done, but once again they were faced with the lack of funds; furthermore, there did not seem to be any way to obtain them.

The junior partner was brimming with plans for expansion. Some of his plans were overly ambitious; others were practical and completely workable. The older men, however, opposed every plan Homer Knowles had to offer, for they would not borrow money, as they did not know when they could repay it.

"All I want to do is to try to get the money," the younger man pleaded. "I give you my word of honor, if I fail to get a loan on the plan I have in mind, I will take your advice and forget a new addition."

After days of discussion and argument, the older men consented and the young partner left town. He did not tell his wife or family where he was going. For several days he was absent; then late one afternoon he walked into his father's office and with a gesture of unconscious drama handed his father a folded paper.

Isaac Knowles opened the document; his partner leaned forward to read it over his shoulder. It was a copy of an agreement drawn up between the *Pittsburgh Dispatch*, a wealthy newspaper, and the firm of Knowles, Taylor & Knowles Company, in which the former agreed to loan the pottery the necessary amount of money to build an eight-kiln pottery. The principal of the note was to be paid from the earnings of the new factory.

The New End was erected immediately, thus raising the capacity of the pottery to thirteen kilns. In 1886, the pottery was producing twice as much ware as any other two potteries in the country. It employed five hundred men and women in its shops, used fifteen tons of clay daily, and turned out a crate of ware every ten minutes. Its sale of ware aggregated a half million dollars a year.

The meteoric rise of the Knowles, Taylor & Knowles Company left the other pottery manufacturers gasping. The organization had only begun, however, to show what it was capable of doing. It was now firmly established as a manufacturer of white graniteware. It had the largest pottery in America, and its output in those days, more than fifty years ago, was considered to be enormous.

Despite their continued successes, Isaac Knowles and his partners were not satisfied. The potters of this country were facing an unfair battle, the battle for the recognition of American ware. The homemakers of the nation knew no other ware except that made in foreign markets and would accept no other. The feeling that merchandise must bear a foreign stamp to be worth while had been handed down from the era of Colonial days, and the feeling of condescension toward domestic products was rampant. The pottery of this country was classed as a poor joke, and the situation became so serious that some of the manufacturers were driven to stamping their ware with a foreign trademark in order to sell it.

The two earliest pottery companies to fight this condition were the Homer Laughlin China Company and the Knowles, Taylor & Knowles Company. Long before any of the other manufacturers decided to assert their independence, these two firms were planning ways of reprisal; e.g., Knowles, Taylor & Knowles planned to manufacture bone china.

Homer Knowles, the dynamic junior partner, had been making cautious explorations in the field of china, and he was determined to produce a ware so beautiful that it would end for all time the insults of the foreign trade promoters. His plans hit a snag when he broached the idea to his superintendents. They did not know how to make bone china. After an extensive search, which delayed his plans for months, he secured the services of Joshua Poole, a young Englishman, who was an authority on Belleek or bone china.

Mr. Poole, though young in years, was well versed in the art of making fine china. His boyhood had been spent in

his father's pottery at Stoke-on-Trent, England. The *East Liverpool (Ohio) Tribune* of December 14, 1889, gives the following account of the potter: "Joshua Poole came to America in 1887 and came to East Liverpool on the advice of the owners of the English clay mines who gave him a splendid recommendation to the Knowles, Taylor & Knowles Company. He has been manager of the Belleek Pottery in the west part of Ireland, famous for its fine ware."

The young man was thoroughly capable of directing the new work of making American china at the Knowles, Taylor & Knowles Company. At that time, there was probably no one else in this country better equipped to do the work. Before the actual process could be put into operation, however, a new factory for the express purpose of producing hotel and bone china had to be built.

Joshua Poole

In 1888, the firm completed the erection of the noted China Works. Old records describing this building called it a "mammoth building," and, according to the standards of those days, it was awe-inspiring in size, as it contained six large double kilns. The firm was now satisfied. They had a man who knew how to make bone china and the factory in which to produce it. In the meantime, they would produce hotel china and keep their plans pertaining to bone china undisclosed.

(1942)

It was five o'clock in the afternoon of November 18, 1889, eighteen months after the completion of the new factory. The citizens of East Liverpool were alarmed by the ringing of the fire bell in the city hall tower. Quickly the volunteer fire department assembled, and in a few minutes the hook-and-ladder wagon dashed through the streets headed toward the north end of town.

The China Works was afire! For two hours the firemen fought the blaze, but it was useless. The magnificent modern pottery burned like a tinder box. The burning of the China Works meant a serious loss to the firm. It had been operating at peak capacity, and the backlog of orders was larger than any in the history of the organization. Now, in a few minutes, all that remained of the once splendid plant were the kiln stacks and windowless walls charred by fire or ruined by smoke and water.

On the north wall of the East Liverpool Historical Society rooms is a mute testimony to the complete destruction of what was then considered the finest pottery building in America. It is a single pane of glass bearing these words:

"Of the 9400 lights of glass in the China Works, this is the only one found whole after the fire of November 18, 1889."

The economic tragedy of the fire was lightened somewhat by the attitude of the workmen. The following letter was sent to the firm at the completion of the second China Works:

"We, the employees of the China Works, desire to express the sympathy which was felt by every one of us on the occasion of the destruction of the factory by fire on November 18, 1889, and our admiration (which was shared by the whole city) of the courage, energy, and promptitude displayed by the firm in rebuilding and re-establishing the works on a large and more complete scale; and last, but not least, our gratitude for the kindness shown by you in providing us with employment elsewhere during the winter.

"Now that the new establishment is completed and will soon be in operation, we feel that we have just reason to congratulate our employers and ourselves on so much having been accomplished in such a short time. Our earnest hope and confidence is that the success of the new China Works may be commensurate with your deserts."

In the spring of 1890, the plant was completed, and everything was in readiness for operation and for the making of bone china. Joshua Poole was given carte blanche and consequently devoted his entire time to the production of the new china. In a few months, the Englishman, working under great secrecy, produced one of the most exquisite china bodies in the history of modern pottery making.

It seemed strange that anything so lovely as this new china could rise above the malodorous manufacturing connected with it. The bones used in the manufacture of the new china were hauled from the slaughter houses along Tanyard Run. Great wagonloads of bone were brought to the factory and dumped into large vats, where they were boiled until every particle of meat dropped away. The bones were then dried, placed in kilns, and burned to a powdery ash. A ventilation system was installed to carry the fumes throughout the shop and to prevent any of the overpowering stench to escape into the neighborhood.

Consequently, the rate of illness was very high among the workmen during those trying days.

Joshua Poole produced his ware. It was startling in its loveliness, its grace of line, and its perfect glaze and body. The workmanship left nothing to be desired. One of the most unusual pieces was a tall, graceful vase, its wide-lipped edges rolling back like the petals of an unfolding flower.

According to tradition, Homer Knowles examined the vase minutely, his face alight with triumph.

"This piece," he said slowly, "looks like a lotus flower."

From this comparison came the name of the rare ware. In spite of its supreme beauty, however, the firm realized that something more was needed to raise the ware from the beautiful to the realm of the artistic. Fragility was not enough. The decorations used on it must be unusual and in keeping with its delicate loveliness.

An eyewitness account of the decorating of lotus ware and the artist who did it was given to the writer as follows by Will T. Blake of Columbus, Ohio, who, when a boy, was the assistant of Henry Schmidt, the German artist who gave the new china its final beauty:

"The name of the young German potter was Henry Schmidt. He came to this country early in the 1890's and, except for a brief period of employment in New York City and Trenton, N. J., he obtained his first steady job with the Knowles, Taylor & Knowles Company. A workbench was provided for his use at the China Works. The clay shop employees at that plant spoke of him as a 'fancy worker,' but the firm members referred to him as an 'artist.'

"His specialty was the ornamentation of vases and bowls that were made for him in the casting shop. These ornamentations usually consisted of flowers and openwork which he made very quickly with the aid of his rubber bag and copper tube that was inserted in the end of the bag. A similar instrument is quite frequently used by bakers to ornament cakes. This receptacle was first filled with a small portion of pliable jellylike clay which could be squeezed through the copper tube upon the slightest pressure of the hand when forming floral or openwork designs.

"Mr. Schmidt originated his own floral decorations and openwork designs. When he was ready to put his clay flowers on a lotus bowl, he would first center the bowl on a whirler and then trace out his particular pattern on the bowl with an undulating movement, much like one would trace an imaginary lead-pencil line around the bowl. The stems, leaves, and flowers of his patterns were produced with remarkable rapidity and skill. He used a small piece of plaster of Paris, a little thicker than a lead pencil and shaped like a petal, to give a more realistic impression to his flowers. This always was done after the clay petals had reached the proper hardness. The stems of these floral designs, and sometimes the leaves that were attached to them, were indented with a sharp tool to give a roughened and more natural effect to them.

"His openwork patterns were first worked out on a small plaster of Paris mold. He would do a quick penciling of his design on the mold and then etch it out slowly with a sharp tool so that, when he went to work on it with his cornucopia bag, these minute indentations served to support the moist clay while the design was drying. When the drying process was complete, the openwork would be removed from the mold by a slight jolt of the plaster form from the hand.

"He would next take the openwork design into his hand and apply a little fresh slip to its outer edges. Then he would attach the design to the vase or bowl on which he was working. This required much care. If too much pressure were applied, the pattern would be crushed and rendered useless."

A perfect example of the workmanship of lotus ware is depicted on this Jewel vase. Note the bead work and intricate flower work. These decorations were put on a smooth-surfaced vase entirely by hand. The vase is a part of the Ruth Cartwright Collection.

Lotus ware was never produced in large quantities. It was created for one purpose, to be a challenge to foreign trade supporters. It was the irrefutable answer to the question, "Can any good thing come out of American potteries?" The cost of manufacture, however, was prohibitive. Mr. Blake continues his account:

"The Company experienced heavy losses in firing lotus ware, chiefly because it had to be fired in the same kilns used for firing the thick, heavy hotel and restaurant chinaware. The kiln men who handled lotus ware were not always able to handle it with the requisite delicacy necessary to prevent breakage, and serious breakage frequently occurred."

Lotus ware was considered to be a luxury line by the firm, and it was common knowledge among them that it cost ten dollars to make one piece of ware which had a

market value of one dollar. Virtually every piece in existence today is considered to be of museum value.

When the World's Fair of 1893 opened at Chicago, lotus ware was displayed and captured blue ribbon after blue ribbon. It was adjudged the loveliest bone china on display at the Fair. The French Commissioner for the museum at Sèvres purchased one of the vases, and a second piece was secured for permanent exhibition at the Swiss Government Art Gallery. The dreamy, fascinating appeal of lotus ware with its delicate flower work and fragile tracery won the admiration and praise of all the critics.

Genuine lotus ware, the co-product of Joshua Poole and Henry Schmidt, was produced by the Knowles, Taylor & Knowles Company for less than a decade. By 1900, the ware was no longer produced. Only recently have the art collectors realized that some of the world's finest bone china was made in East Liverpool more than forty years ago.

Creating the exquisite body and designs for lotus ware was not the only accomplishment of Joshua Poole, for he produced unusual colored-bodied ware which was shaped into vases of exquisite lines and decorations. The decorations were applied by Henry Schmidt, who used his flower work on these pieces of ornamental ware as well as on the lotus ware. The colored-bodied ware was produced in light and dark blue and in green. The rich shades were not obtained by glazes, but by colored bodies, a secret Mr. Poole had obtained from his father during the years he spent under the older man's supervision in England. There are today few of these vases extant.

Joshua Poole remained with the Knowles, Taylor & Knowles Company as superintendent of its china production until about 1907, when he accepted a similar position with the Homer Laughlin China Company. He was also vice-president of the Edwin M. Knowles China Company until his death in March, 1928.

During the years Isaac Knowles, a man in his seventies, and his associates were producing lotus ware, the other lines of the pottery were swinging along in full production. The firm, under the name of "K. T. & K. Co.," had a capital stock of one million dollars, and Homer Knowles' dream of having the largest pottery in the world became a reality.

Isaac Knowles died in 1902, and the decades following his death found the pottery classed as the leader of pottery making. It continued as such until thirteen years ago when the disastrous merger of many important potteries under the name of the American Chinaware Corporation brought about the failure and eventual closing of the pottery.

In 1931, the merger declared bankruptcy, and the Knowles, Taylor & Knowles Company became a memory. The plants were razed, and the sites of the Old End, New End, Buckeye, and China Works gradually were rebuilt to accommodate garages, markets, recreation fields, and gasoline stations.

The pottery founded by Isaac Knowles in 1853 carved a place for itself in the annals of pottery history on two counts, at least, if for no other reasons—it introduced machinery into ceramics and it created lotus ware.

JOHN DAVID BIGGERS OF THE LIBBEY-OWENS-FORD GLASS COMPANY

John David Biggers, president of the Libbey-Owens-Ford Glass Co., Toledo, Ohio, has been granted the Doctor of Laws degree by the University of Michigan, his alma mater, in recognition of his work in Washington with the Office of Production Management.

HIS FIRST JOB*

While at college, John D. Biggers met two Detroit businessmen for whom he felt a deep admiration. He was nearing the end of his schooling and he decided to ask these men for a job as soon as he was graduated. When that time came, Abner Larned and David Carter, owners of a company manufacturing overalls, hired the 20-year-old graduate of the University of Michigan, and he went to Detroit to his first real job. There he was introduced to the office force of the company and apprised of his duties, not the humblest of which consisted of rising very early in the morning to pick up the company's mail at the post office. His salary was $50 per month.

When friends asked him what he wanted to do in business, John Biggers always answered unhesitatingly, "I want to be a salesman." And at first he got his wish, for he became junior traveling salesman for the overalls company. Then, after several months in this work, he was made advertising manager.

The respect John Biggers felt for his employers was reflected in their appreciation for his hard work and eagerness to learn. When Mr. Larned was elected president of the Detroit Board of Commerce, he gave young Biggers the job of membership secretary, which fitted him for later service as assistant secretary of the Board.

In 1911, having heard of his success in Detroit, a group of Toledoans asked him to become secretary of the Toledo Chamber of Commerce, and just before reaching the age of 23 he moved to the nation's glass capital. It was here that he met Edward Drummond Libbey and Michael J. Owens, two great men in glass. In 1914, he became assistant treasurer of the Owens Bottle Company, where he advanced rapidly to the positions of treasurer, assistant general manager, and vice-president in charge of sales.

In 1926, after the death of Messrs. Libbey and Owens, Mr. Biggers became managing director of Dodge Brothers, Britain, Ltd., London, England, where he remained with his wife and children for one year. During this period, he and his associates greatly increased the sale of Dodge automobiles in the British Isles. Here he again proved his business ability.

Returning to the United States in 1927, Mr. Biggers became vice-president of the Graham Brothers Corporation, New York City. While associated with the Graham Brothers, he also served as vice-president of the Graham-Paige International Corp., New York and Detroit.

In 1927, he became interested in the Libbey-Owens-Ford Glass Company and served as a director until he became president of the Company after it had merged with the Edward Ford Plate Glass Company in 1930.

Thus, after five years of experience in the automobile industry, John Biggers returned to his favorite business, the manufacture and sale of glass. He had held firmly to the belief that to work most efficiently and successfully a man must respect and admire his superiors. He had started his career with Messrs. Larned and Carter, had gone to

* From the *La Salle County Ledger*, February 26, 1942.

Toledo and the Owens Bottle Company, and had joined the Dodge Brothers in 1926. Each change was made because he admired the men with whom he worked.

BIOGRAPHY

BORN: December 19, 1888, St. Louis, Mo.

EDUCATION: Public schools and Smith Academy, St. Louis; Washington University, St. Louis (1 year); University of Michigan (3 years) (was graduated at twenty with an A.B. degree).

RELIGIOUS AFFILIATION: First Congregational Church, Toledo, Ohio.

MARRIED: Mary Isobel Kelsey of Toledo, Ohio, October 22, 1912.

CHILDREN: Reeve Kelsey Biggers, Mary Sherret Biggers, and Jane Lowry Biggers.

CAREER: Junior traveling salesman for Larned-Carter Co. (manufacturers of overalls), Detroit, Mich., at $50 a month, and promoted to advertising manager within year, 1909; assistant secretary, Detroit Board of Commerce, 1910–1911; secretary, Toledo Chamber of Commerce, Toledo, Ohio, 1911–1914; successively assistant treasurer, treasurer, assistant general manager, and vice-president and sales manager, Owens Bottle Co., Toledo, Ohio, 1914–1926; managing director, Dodge Brothers, Britain, Ltd., London, England, 1926–1927; vice-president, Graham Brothers Corp., New York, N. Y., and Graham-Paige International Corp., Detroit, Mich., 1927–1930; president, Libbey-Owens-Ford Glass Co., Toledo, Ohio, 1930 to date.

Appointed September, 1937, by President Roosevelt as administrator of the Census of Partial Employment, Unemployment, and Occupations. Completed task and resigned October, 1938 (served on this assignment without compensation).

In June, 1940, appointed Deputy Commissioner of production to the Advisory Commission to the Council of National Defense in Washington, D. C., where he served without compensation. In January, 1941, appointed Director of the Division of Production of the Office of Production Management; served in that capacity until September, 1941. Appointed Special Minister to Great Britain for the Lease-Lend synchronization; served from September to November, 1941 (given leave-of-absence to return to important task of converting the Libbey-Owens-Ford Glass Company to war work).

CIVIC and MISCELLANEOUS ORGANIZATIONS: Trustee, Toledo Museum of Art and of Boys' Club of Toledo; member: Executive Committee of Toledo Community Chest, Army Ordnance Association, and Detroit Committee on Foreign Relations; member and past-secretary, Toledo Chamber of Commerce; member and past vice-chairman, Business Advisory Council for the Department of Commerce, Washington, D. C.

SOCIAL AND FRATERNAL ORGANIZATIONS: Sigma Alpha Epsilon (Iota Beta chapter, Ann Arbor, Mich.), Toledo Club, Toledo Country Club and Carrancr Club, Toledo, Ohio; Recess and Detroit clubs, Detroit, Mich.; Indian Creek Club, Miami Beach, Fla.; Chevy Chase and 1925 F Street clubs, Washington, D. C.

HONORARY DEGREES: LL.D., Defiance College, 1938; University of Toledo, 1941; University of Michigan, 1942.

RESIDENCE: 4365 Brookside Road, Toledo, Ohio.

John David Biggers

CLYDE ELMER WILLIAMS, DIRECTOR OF BATTELLE MEMORIAL INSTITUTE

More than any other one man, Clyde E. Williams has his finger on the pulse of the metallurgical situation of our country at war. As chairman of the War Metallurgy Committee of the National Research Council, which conducts the metallurgical research program for the Office of Scientific Research and Development, and as chairman of the Advisory Committee on Metals and Minerals for the War Production Board, Mr. Williams has an intimate and thorough knowledge of metals and the war and of the varied and intricate problems of utilization, conservation, and substitution.

In addition to these responsibilities, he is director and active head of Battelle Memorial Institute, Columbus, Ohio, one of the largest industrial research organizations in the country.

Biography

Mr. Williams was graduated from the University of Utah in 1915 with a B.S. degree in chemical engineering, after which he entered the employ of the U. S. Smelting & Refining Co., Midvale, Utah, as a chemist. He later held a graduate fellowship in nonferrous metallurgy at the U. S. Bureau of Mines at the University of Utah. During World War I, he conducted research on alloy steels in the government laboratories at Cornell University. Following that, he was associated with the Hooker Electrochemical Co., Niagara Falls, N. Y., for two years.

From 1920 to 1924, he was superintendent of the Northwest Experiment Station of the U. S. Bureau of Mines at Seattle, Wash. While in Seattle, he was elected to Sigma Xi, honorary scientific fraternity. He spent several

months in 1924 and 1925 in the Argentine making a survey of its metallurgical resources for the Argentine government. In 1925, he became chief metallurgist for the Columbia Steel Co., a subsidiary of the U. S. Steel Corp., in San Francisco, Calif. In 1929, he moved to Columbus to become assistant director of the newly established Battelle Memorial Institute. He became director in 1934.

Mr. Williams specializes and has particular interest in iron and steel metallurgy, refractories, electrothermics, iron and steel foundry and open-hearth and blast-furnace practice, fuel utilization, economics of the metals industry, and industrial research. He has numerous patents, publications, and technical articles on these subjects to his credit.

Mr. Williams is a member of the American Iron and Steel Institute, the American Institute of Chemical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society for Metals, the American Railway Engineers Association, the British Iron and Steel Institute, the Electrochemical Society, the American Refractories Institute, and Sigma Xi.

He has been a member of The American Ceramic Society, Inc., since 1930.

Clyde Elmer Williams

TEN THOUSAND LABORATORY EXPERTS AND SCIENTISTS TO HANDLE WAR METALLURGICAL RESEARCH

How 125,000 Man-Years of Research, Experience, and Confidential Laboratory Data Are Being Brought to Bear on the Problems of Metals for War

The Metals and Minerals Advisory Committee of the National Academy of Sciences in its eighteen months of operation has furnished the Office of Production Management and the War Production Board with 113 reports, 53 of which have been on metals substitution and conservation, 47 on ferrous minerals and ferroalloys, 4 on tin smelting and reclamation, and 9 on nonmetallic minerals.

(1942)

The work of the Advisory Committee has been greatly enlarged since December 7, 1941, and will be increased still further as it functions with and for a committee which has just been set up, the War Metallurgy Committee. Clyde E. Williams, Director, Battelle Memorial Institute, Columbus, Ohio, chairman of the Advisory Committee, will also serve as chairman of this new Committee.

It is the function of this Committee to collect data and information as requested by either the War Production Board or the National Defense Research Committee of the Office of Scientific Research and Development and to plan, present, and supervise definite research projects for either war materials or armaments.

War Metallurgy and Advisory Committees to Function as Nerve Center

The War Metallurgy Committee and its Advisory Committee are set up to function as the nerve center for all metallurgical research organizations and departments in this country, inasmuch as, depending upon the problem involved, the heads of any business, university, or research organization can be counted upon by this Committee to make available the experience of their metallurgical scientists and engineers or their laboratory data.

Saving Time, Mistakes, and Money

One of the basic considerations in the operation of this Committee is that of the saving of time, mistakes, and money. When the problem is proposed, through either the War Production Board or the Office of Scientific Research and Development, immediate action can be obtained by telephone communication with the leading scientists on that particular subject; initial Committee meetings are often held within twenty-four hours, and, if the request is urgent, within that same day a plan of procedure is laid down and submitted.

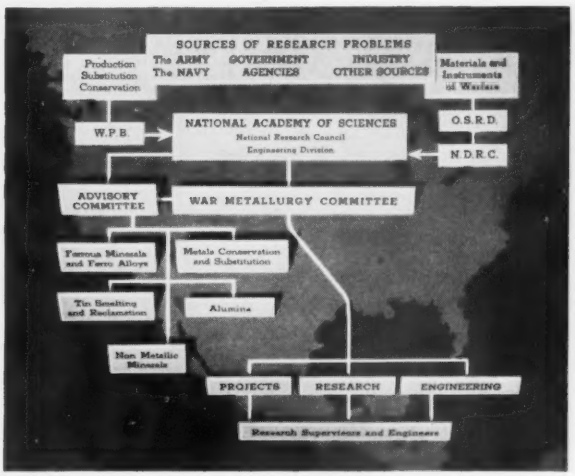


Chart showing position of War Metallurgy Committee in the National Academy of Sciences research organization

Furthering War-Winning Research

Everyone in this country, and scientists and industrialists are no exception, is naturally anxious to contribute everything he can toward winning the war. New thoughts, ideas, and short-cuts are constantly coming to the front. Although it is not the place of the War Metallurgy Committee to be the repository for such suggestions and ideas, it recognizes as a very definite part of its wartime job the appraisal of such of these problems and possibilities as are referred to it by the War Production Board or the Office of Scientific Research and Development.

English and Canadian Research

Another important function of the War Metallurgy Committee is to digest and make available to those properly interested through their participation in the war

effort the results of both Canadian and English metallurgical research. Both Canada and England obviously have a great many of the same problems which confront this country, and the interchange of information through the proper channels makes available to everyone the best thinking and practice of scientists and industrialists on both sides of the Atlantic.

Committee Membership

Indicative of the type of scientists and organizations represented is the make-up of the War Metallurgy Committee and the Advisory Committee.

The War Metallurgy Committee is composed of twenty-six members, as follows: Clyde E. Williams, *Chairman*, Director, Battelle Memorial Institute, Columbus, Ohio; Zay Jeffries, *Vice-Chairman*, Technical Director, General Electric Co., Cleveland, Ohio; Louis Jordan, *Secretary*, National Academy of Sciences, Washington, D. C.; Carl Breer, Vice-President, Chrysler Corp., Detroit, Mich.; Lyman J. Briggs, Director, National Bureau of Standards, Washington, D. C.; Colonel H. H. Zornig, Ordnance Department, Watertown Arsenal, Watertown, Mass.; James H. Critchett, Vice-President, Union Carbide & Carbon Research Labs., New York, N. Y.; Colonel R. S. A. Dougherty, Manager, Research & Development, Bethlehem Steel Co., Bethlehem, Pa.; Rudolph Furrer, Vice-President, A. O. Smith Corp., Milwaukee, Wis.; H. W. Gillett, Chief Technical Adviser, Battelle Memorial Institute, Columbus, Ohio; S. D. Heron, Ethyl Gasoline Corp., Detroit, Mich.; R. P. Heuer, Vice-President, General Refractories Co , Philadelphia, Pa.; Colonel G. F. Jenks, Ordnance Department, Washington, D. C.; John Johnston, Director, Research Lab., U. S. Steel Corp., Kearny, N. J.; Vsevolod N. Krivobok, Director of Research, Lockheed Aircraft Corp., Burbank, Calif.; Frederick Laist, General Metallurgical Manager, Anaconda Copper Mining Co., New York, N. Y.; W. K. Lewis, Head, Dept. of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.; C. E. MacQuigg, College of Engineering, Ohio State University, Columbus, Ohio; C. E. McCuen, Vice-President, General Motors Corp., Detroit, Mich.; Robert F. Mehl, Director, Metals Research Lab., Carnegie Institute of Technology, Pittsburgh, Pa.; Paul D. Merica, Vice-President, International Nickel Co., Inc., New York, N. Y.; Gilbert E. Seil, Technical Director, E. J. Lavino & Co., Norristown, Pa.; Captain Lybrand Smith, Office of Coordinator of Research & Development, Navy Department, Washington, D. C.; F. W. Willard, President, Nassau Smelting & Refining Co., New York, N. Y.; Robert S. Williams, Head, Dept. of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.; and Colonel A. E. White, University of Michigan, Ann Arbor, Mich.

The Advisory Committee is composed of sixty-three regular members, plus the special members in the following groups: Ferrous Minerals and Ferroalloys Group (11 members), the Metals Conservation and Substitution Group (27 members), the Nonmetallic Minerals Group (14 members), the Tin Smelting and Reclamation Group (6 members), and the Alumina Subcommittee (5 members).

The personnel of the Nonmetallic Minerals Group is as follows: R. P. Heuer, *Chairman*, General Refractories Co., Philadelphia, Pa.; Paul Tyler, *Secretary*, U. S. Bureau of Mines, Washington, D. C.; L. E. Barringer, General Electric Co., Schenectady, N.Y.; G. A. Bole, Edward Orton, Jr., Ceramic Foundation, Columbus, Ohio; B. C. Burgess, United Feldspar & Minerals Corp., Spruce Pine, N. C.; W. S. Landis, American Cyanamid Co., New York, N. Y.; M. M. Leighton, State Geological Survey Div., University of Illinois Campus, Urbana, Ill.; G. R. Mansfield, U. S. Geological Survey, Washington, D. C.; Oliver C. Ralston, U. S. Bureau of Mines, College Park, Md.; Robert B. Sosman, Research Lab., U. S. Steel Corp., Kearny, N. J.; John D. Sullivan, Battelle Memorial Institute, Columbus, Ohio; Frank J. Tone, Carborundum Co., Niagara Falls, N. Y.; William M. Weigel, Missouri Pacific Railroad Co., St. Louis, Mo.; and R. B. Wittenberg, International Agriculture Corp., New York, N. Y.

The Alumina Subcommittee is made up of the following members: John D. Sullivan, *Chairman*, Battelle Memorial Institute, Columbus, Ohio; Francis C. Frary, Aluminum Co. of America, New Kensington, Pa.; Oliver C. Ralston, U. S. Bureau of Mines, College Park, Md.; R. S. Sherwin, Reynolds Metals Co., Sheffield, Ala.; and Arthur Fleischer, Kalunite Co., Salt Lake City, Utah.

In addition, twenty other specialists are called in frequently for advice on specific problems.

Associations and Technical Societies

The associations and technical societies in the metallurgical field are taking a most active part in the problems of metallurgical reports and research. Among those now functioning are the American Institute of Mining and Metallurgical Engineers, the American Society for Testing Materials, the American Society of Mechanical Engineers, the American Society for Metals, the Society of Automotive Engineers, the Engineers Defense Board, the American Institute of Chemical Engineers, the Army Ordnance Association, the American Iron and Steel Institute, and The American Ceramic Society, Inc.

WAR EMERGENCY

NEEDED FOR CIVILIAN WAR SERVICE NOW

Business Men with Training and Experience in Ceramics and Allied Manufacturing

TITLE OF POSITION: Industrial Specialist (stone, clay, and glass products) $2600 to $6500 (various grades).

Specialized Fields

(1) Flat glass
(2) Glass and glassware (pressed or blown)
(3) Glass products not made by glass manufacturers
(4) Cement
(5) Structural clay products
(6) Pottery and related products
(7) Concrete, gypsum, and plaster products
(8) Abrasive, asbestos, and miscellaneous nonmetallic mineral products

Most of these positions are with the War Production Board, but some will be filled in other war agencies.

DUTIES: To formulate or direct priority, substitution, allocation, or price control programs; to serve as liaison representative in developing and maintaining close working relationship with manufacturers of materials or equipment for the war program and to obtain information with respect to industrial production; to act as a consultant on matters pertaining to industrial materials or industrial methods and processes; to examine and evaluate data in reports from various industrial concerns and to make recommendations therefrom; or to direct or conduct investigations and analyses in the field of industrial materials involving the collection of data relative to production techniques, uses, consumption, and market supplies of particular materials. The duties, responsibilities, and salary of any particular position will depend on the grade to which appointment is made.

MINIMUM QUALIFICATIONS: Applicants must have had training and experience of a length and quality to insure their familiarity with processes of production. Knowledge of methods of operation, technical terminology, marketing and distribution methods characteristic of the industry, markets for finished products, sources of raw material, and the structure of one or more of the industries represented by the specialized fields previously listed is desirable. For the $2600 grade, at least two years of progressively respon-

sible qualifying experience must be shown, and for the higher grades, increasing responsibility commensurate with the duties of the higher grade positions.

NONQUALIFYING EXPERIENCE: Experience restricted to selling at retail, shop foremanship, labor supervisors, and similar types of positions will *not* be considered qualifying.

Persons who have been rated eligible in the Industrial Specialist examination under Announcement No. U-102 of 1941 need not file additional applications.

Location of Positions: In Washington, D. C., and in regional and district offices throughout the United States.

Applicants should indicate the *lowest acceptable salary*, and the application should show the exact *complete title of position* as given on the opposite page.

General Information

(1) Applications will be accepted until the needs of the service have been met.

(2) Applicants must be citizens of or owe allegiance to the United States. Foreign-born applicants must furnish proof of citizenship.

(3) Applicants must be physically capable of performing the duties of the position and be free from such defects or diseases as would constitute employment hazards to themselves or danger to their fellow employees.

(4) No written test is required. Applicants' qualifications will be judged from a review of sworn statements as to their experience, education, and training and on corroborative evidence secured by the Civil Service Commission.

(5) Appointments will be known as war service appointments. Such appointments generally will be for the duration of the war and in no case will extend more than six months beyond the end of the war.

(6) All salaries are subject to a 5% deduction for retirement purposes.

(7) Applicants must file the following forms with the United States Civil Service Commission at Washington, D. C.: (*a*) Application Form 8 *or* Application Form 57. NOTE: To be eligible for appointment in the apportioned service, applicants must (1) have the Officer's Certificate of Residence executed, if Form 8 is filed, *or* (2) file Residence Form 12, properly executed, if Application Form 57 is filed; (*b*) Application Card, Form 4006-ABCD; and (*c*) Form 14 and proof of honorable discharge should be submitted by applicants who desire their records of service in the armed forces to be considered.

(8) The necessary forms may be obtained from the Secretary, Board of United States Civil Service Examiners, at any first- or second-class post office, except in the following district headquarters' cities, where the forms must be obtained from the United States Civil Service District Office: Atlanta, Ga., new Post Office Building; Boston, Mass., Post Office and Courthouse Building; Chicago, Ill., new Post Office Building; Cincinnati, Ohio, Post Office and Courthouse; Denver, Colo., new Customhouse; New Orleans, La., Customhouse; New York, N. Y., Federal Building, Christopher St.; Philadelphia, Pa., Customhouse, Second and Chestnut Sts.; Seattle, Wash., Post Office Building; St. Louis, Mo., new Federal Building; St. Paul, Minn., Post Office and Customhouse; San Francisco, Calif., Federal Office Building; Honolulu, Territory of Hawaii, Federal Building; Balboa Heights, Canal Zone, Secretary, Board of United States Civil Service Examiners; and San Juan, Puerto Rico, Chairman, Puerto Rican Civil Service Commission.

The forms may also be obtained from the United States Civil Service Commission, Washington, D. C. The title of the examination desired should be stated.

STRUCTURAL CLAY PRODUCTS OFF RESTRICTED LIST

A large group of slow-moving, noncritical building materials has been specifically released from the restrictions imposed by Suppliers' Inventory Limitation Order L-63 under the terms of Exemption No. 5 to the order issued on June 23 by the Division of Industry Operations of the War Production Board.

Dealers holding stocks of the following materials need no longer include them in the records and reports called for by L-63, although they remain subject to the inventory restrictions of Priorities Regulation No. 1: Portland and natural cement, lime, gypsum and gypsum products, bituminous roofing materials, concrete pipe, cut stone, sand and gravel, crushed stone, clay products, insulation board, acoustical materials, mineral wool, paving materials, concrete products, glass, lumber, and wooden millwork.

All other categories of builders' supplies remain subject to all the terms of the Suppliers' Inventory Limitation Order.

GLASS GOES TO WAR*

BY T. J. THOMPSON

Introduction

Glass, by releasing other more critically needed materials for war purposes and by its direct use as an important and unique material of construction, is playing an important part in the present war program. It is the purpose of this paper to bring to light a few of the applications of glass of long standing which now have a new and important significance.

Three Decades of Progress

During the twenty-eight years since the opening of hostilities in World War I, glass has made an increasingly important place for itself, both in industry and in the home. Perhaps the most important single milestone in its progress during that period was the development of hard borosilicate glasses by Eugene C. Sullivan and William C. Taylor in 1914.[1] These glasses constituted a long step forward in the search for glass having the highly desirable properties of quartz (i.e., the perfect glass), but which, in contrast with quartz, could be melted readily and formed into usable shapes. Their remarkable combination of heat and chemical resistance, coupled with excellent mechanical and dielectric properties, instantly opened the gates to broad new fields of useful applications. Stemming from the important discovery of Sullivan and Taylor and stimulated by it, research and development work of ever-broadening scope has pried loose a flood of new knowledge of glass and its properties and the practical ways to utilize them to enhance our way of life.

Another major milestone in the progress of glass was the subsequent discovery of ways and means of doubling or tripling the mechanical strength of glassware and, at the same time, improving still further its resistance to heat-shock by "tempering" or "heat processing" for use over open-flame or electric range heating elements.

More recently, the remaining gap between glass and quartz has been nearly closed by the development of 96% silica glass by H. P. Hood and Martin E. Nordberg.[2] Their new process not only makes possible the commercial production of quartzlike ware with conventional glassforming methods, but slip-casting may be used to make this unique glassware available in sizes, shapes, and intricate patterns heretofore impossible to attain. The new tool thus made available to industry is still in its infancy, but the scope of its usefulness broadens almost daily.

Glass Piping

One of the earliest and most obviously useful industrial applications of the heat and chemical resistance of borosilicate glassware was for the piping of hot, corrosive solutions in the growing chemical industry. It is more than sixteen years since the first crude glass piping was installed.

* Presented at the Forty-Fourth Annual Meeting, The American Ceramic Society, Cincinnati, Ohio, April 21, 1942 (General Sessions on War Emergency Problems; Mr. Thompson represented the Glass Division in the Symposium on "Ceramics in War Emergency"). Received April 21, 1942.

[1] U. S. Pat. 1,304,623.

[2] U. S. Pat. 2,221,709, November 12, 1940.

A succession of improvements in the design of piping and fittings and in fabrication methods followed, until today breakage no longer holds any fear for experienced users. Every major producer of chemicals in this country and many of the smaller ones now use glass piping in substantial quantities for conveying, heating, cooling, and for the absorption of a myriad variety of corrosive liquids or gases, many of which are vitally essential to the production of explosives, poison gases, high-octane airplane fuels, magnesium, and other war materials. Manufacturers of drugs, pharmaceuticals, reagent chemicals, vitamins, and biological compounds also have serious corrosion problems; they are mostly concerned, however, with the purity of their products. In many instances, glass equipment has proved to be the answer to both problems.

The food and beverage industries have more recently learned the advantages of glass piping, particularly those large groups working with acidic products such as tomatoes, fruit juices, vinegar, pickling brines, organic acids, and phosphoric and sulfuric acids. Important as the corrosion problem is in the handling of such fluids, an even more difficult problem is the maintenance of sanitation. Fortunately, the "glass smoothness" of glass piping makes it easier to clean than almost any other material.

The latest innovation in glass piping is the electric welding of joints to eliminate or to reduce the number of joints. By means of portable equipment, which generates suitable high-frequency currents, the tube ends can be quickly welded together in place and subsequently annealed in short order, thus eliminating almost entirely the need for metal flanges and special gaskets.

Centrifugal Pumps

Supplementing glass piping is a new line of glass centrifugal pumps. Since the introduction of the first model about three years ago, hundreds of pumps have been placed in operation in some of the "toughest" pumping services in the chemical industry. Although the pumps are well armored and protected by metal, they are so designed that the liquids do not come in contact with any metal. Their volutes, headplates, and impellers are all made of glass; these parts, incidentally, are finished precisely to dimensional tolerances as close as those of high-grade metal pumps. A unique stuffing-box arrangement employs a rotary ring-seal, the rotating member of which is made from 96% silica glass, whose thermal-shock resistance is so great that the pump may be allowed to run dry without fear of breakage from the frictional heat thus generated in the stuffing box and the resultant thermal shock when cold liquid again enters the pump. The "glass smoothness" of the ring's operating face enhances over-all pump efficiency by reducing friction drag, and its chemical stability assures long life and trouble-free operation in corrosive service which would quickly destroy the highest grade of metal shafts and stuffing-box assemblies. The pump impeller illustrates the manner in which glass and metal can be joined together to provide a strong assembly with the advantages of both and the weaknesses of neither. The glass impeller disk is molded with an integral, hollow stub shaft having longitudinal splines and radial grooves. A metal plug with corresponding splines and grooves is dropped in and locked permanently in place mechanically with a low-melting metal alloy.

Precision Bore Ware

The art of forming glass on a mandrel to an extremely precise shape and size is no longer new, but great strides are being made in further utilizing its useful combination of qualities. Its great accuracy, transparency, and requisite mechanical strength form the basis for the design of new instruments for the visual indication of flow of liquids or gases under pressure and for the construction of precisely formed mechanical parts, e.g., (1) rotameters of the type now widely used in the chemical industry and (2) some of the newer, interesting applications in war planes.

Foamglas

The shortage of cork for low-temperature insulation and of magnesia, asbestos, and other materials for higher temperatures will soon be at least partially alleviated by foamed or cellulated glass. Foamglas will be available in standard blocks and special shapes with a density of only 10 to 11 lb. per cu. ft. and a thermal conductivity of 0.45 B.t.u./hr./sq. ft./°F./in. at 70°F., which compares favorably with cork under actual service conditions. The low density is attained by the incorporation of small totally enclosed gas bubbles. The material, therefore, has no interconnecting pores or channels and cannot become soggy or lose efficiency upon exposure to water or dampness incident to refrigeration or other wet service conditions. Its upper temperature limit of 1000°F. permits a broad range of industrial applications. Of equal interest is its relatively great mechanical strength as compared with most insulating material. It has a tensile strength of approximately 100 p.s.i. and a crushing strength of 150 p.s.i., thus providing a substantial load-carrying capacity. It can also be walked upon without serious damage. Foamglas may also be used for floats and in lifeboats, life rafts and life preservers, fishing corks, and pontoon bridge floats.

Conclusion

Glass is playing a vital role during these critical days, even though some of its applications are of the "substitute" variety and are therefore of temporary interest only, and the ever-expanding knowledge of its properties and uses discloses it as an astonishingly versatile material which is destined to play an increasingly important part in rebuilding and enhancing our standard of living during the reconstruction period after the war.

Corning Glass Works
Corning, New York

PORCELAIN ENAMEL IN WAR WORK*

By Charles S. Pearce

"Ceramics in War." This is a subject to excite the imagination, for we think of war in terms of steel, not of brick; in terms of bombs, not of buildings; in terms of bullets, not of buckets. But who can forget that modern sanitation depends upon ceramics, and modern war depends upon sanitation? For the first time in history, more men will die from bullets than from disease.

The effort of the porcelain enamel industry breaks down into several parts, namely, (1) the replacement of critical materials both in civilian and war use; (2) the assistance with plant expansion for the war effort; (3) protective coatings for war purposes; (4) new products essential to the war; (5) conversion of plants and organizations to war production; and (6) although not exactly pertaining to the direct winning of the war, the reconversion to peacetime activities with the consequent re-employment of personnel.

(1) Replacement of Critical Materials

In Civilian Use: Porcelain enamel has replaced nickel, chromium, and copper in plumbing fixtures where Monel and some stainless steel were formerly used, but more important is the recent replacement of copper and brass in the manufacture of plumbing fittings. This is assuming a great deal more importance than it did some months ago owing to the recent drastic limitations in the use of copper.

Enameled kitchenware has definitely replaced aluminum and stainless steel in that field. In fact, porcelain-enameled kitchenware is now being produced at a more rapid rate than at any time in the past, except perhaps during

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* Presented at the Forty-Fourth Annual Meeting, The American Ceramic Society, Inc., Cincinnati, Ohio, April 21, 1942 (General Sessions on War Emergency Problems; Mr. Pearce represented the Enamel Division in the Symposium on "Ceramics in War Emergency"). Received April 19, 1942.

1941. This is one of the greatest substitutions which has been made and is probably one that will release huge quantities of aluminum for aviation use.

The use of porcelain enamel as a protective finish is most forcibly shown in the hot-water-tank field. This has been the most recent application for this type of substitution.

In War Uses: Porcelain enamel has not found the great place in substitution that was at first thought possible. It has been substituted, however, for (1) aluminum in the manufacture of canteens; (2) stainless steel or stainless clad in the manufacture of mess trays; and (3) the non-corrosive metals that were formerly used in coffee urns.

(2) Assistance with Plant Expansion

Industrial Plants: The expansion of the industrial plant finds many uses for porcelain enamel, e.g., for reflectors. A great increase in fluorescent lighting has caused a four-fold increase in the production of reflectors during the past two years. A large portion of this production is going into the expansion of the war industries.

The use of porcelain enamel as lining and partition material for shower baths also has been extensively developed.

Some building exteriors of the conventional porcelain-enameled type have been erected for aircraft plants, and it is also probable that a number of other industrial buildings will use porcelain enamel as a finish to replace ordinary building materials.

The use of porcelain enamel as a substitute for copper and galvanized iron for termite shields in the construction of wooden buildings, although discussed, has not progressed very far.

War Housing: Porcelain enamel is being used in the expanded war housing program (1) in smoke pipes for the conduction of flue gases from heating equipment, usually oil or gas (an old use for porcelain enamel in the Middle West, but only recently adopted on a large scale in what might be considered to be temporary buildings), and (2) as cornices or gravel stops. It is probable that in the future even more of our material will enter into the construction of small housing units.

(3) Protective Coatings for War Purposes

Corrugated iron to replace galvanized and asbestos-protected material will undoubtedly find wider uses than at the present time. It has been specified by officials in the Panama Canal Zone where it has been given an effective test and probably will be used on more installations of this type. In this particular case, it replaces large quantities of galvanized material.

Airport cones of porcelain enamel have been specified recently in the section of the country where sandstorms are encountered because of their (1) durability to storm conditions and (2) their continued high color permanence.

Porcelain enamel-finished products for chemical warfare are just being developed, but it is quite possible that porcelain enamel, with the addition of many highly corrosive chemicals to the tools of the fighting man, will become a necessary part of the finishes that are applied to certain products. This is in the formative stage and naturally has not been pushed rapidly owing to the lack of the use of such implements. Once this type of warfare does start, it is probable that finishes of the ceramic type will be called upon more and more.

(4) New Products Essential to the War

Every manufacturer hopes to find some product which will fit into the war program and, at the same time, use his present established manufacturing processes. In other words, he hopes for a wartime product which will fit definitely into his peacetime schedule of manufacture. Only one product of this type has been developed by the porcelain enameling industry to date, namely, a table top for cantonments in the permanent establishments of the Army. A small start was made at this work early in the present building program, but it has largely been abandoned owing to the necessity for the conservation of both iron and steel and to the hesitancy of the Army to specify this product at this particular point. The development is going forward, however, and it is possible that permanent establishments of the Army will in the future use some kind of ceramic-finished table top. There are no other products to report in this classification at the present time, although others will develop. It is possible that the war effort will require more permanent finishes if the war drags out to a longer time.

(5) Conversion of Plants and Organizations

The most helpful work which the porcelain enameling industry can do for the war program is to convert its plants to the production of war products. Although this is not ceramic work, it is converting a normally ceramic industry over to the war effort. Because of our facilities for the handling of metal under heat, it has been possible to carry out many operations involving the use of comparatively light metal which are not possible in the usual sheet-metal-working plants or in the heavy metalworking industries, e.g., (1) the manufacture of aerial bombs. This work is going on actively at the present time in three plants which were formerly used only for porcelain-enamel products. The production of such metal probably will be large, and more and more plants will be called into play. (2) The heat-treating of armor plate in many of the plants. The 550 box furnaces in existence in the United States undoubtedly will provide plenty of capacity for the heat-treating of armor plates for both tanks and the small production needed for airplane use. (3) The manufacture of thermit for incendiary bombs. Although this line of manufacture is in the chemical field, it provides use for the facilities and the technical information which are available in porcelain-enamel plants.

In the near future, porcelain enamel may be used in the food processing field. Our industry is considered to be rather expert in the drying of materials. For this reason, the drying of food products may fit into the channels which we have already developed and may become a large factor in the use of the present plants.

Man power is one thing which the porcelain enameling industry has available—(1) man power of a little higher skill than is generally found in American industry principally because of the necessity of properly controlled heat and (2) technical man power which will be turned over to use on war products. Plants with available engineering and technical personnel are probably best fitted to enter into the war program at the present time.

(6) Reconversion to Peacetime Activities

In the rush of wartime manufacture, it should not be forgotten that the industry must again be converted back to peacetime work and that the employees who have been so carefully trained in the production of lethal instruments must again be trained to produce peacetime products. This is one of the biggest problems which faces any industry today, particularly those industries which convert ccmpletely to a new type of product. These factors must be kept in mind, and any kind of a change-over must be completely reversed later if the industry is to live after the present emergency has passed.

I would like to quote from Henry Van Dyke's "A Handful of Clay." The lump of clay had been taken from its bed and made into a common flowerpot. It was very discontented with its plight until

"One day, the clay was lifted again from its place and carried into a great church. Its dream was coming true after all. It had a fine part to play in the world. Glorious music flowed over it. It was surrounded with flowers. Still it could not understand. So it whispered to another vessel of clay, like itself, close beside it, 'Why have they set me here? Why do all the people look toward us?' And the other vessel answered, 'Do you not know? You are carrying a royal sceptre of lilies. Their petals are white as snow, and the heart of them is like pure gold. The people look this way because the flower is the most wonderful in the world. And the root of it is in your heart.'

"Then the clay was content and silently thanked its maker, because, though an earthen vessel, it held so great a treasure."

The porcelain enameling industry is doing its full share in the production of war products, and the ceramic industry has a large place to fill in the present cataclysm. Only when peacetime products are its regular line of manufacture, however, will the ceramic industry blossom into full beauty.

I Will Be Selfish Enough to Put My Head Together With Others

My Membership in The American Ceramic Society Is for a Selfish Purpose

AFTER VICTORY—WHAT?*

By Bennett Chapple

The challenge we are facing today is one that is calling for all of the strength that we have. History has never recorded a time when the whole world was in an upheaval such as it is today. We are in a time of the greatest military crisis, and after the war we know we will have an economic crisis such as the world has never faced before. Such a challenge calls for an active outpouring of the spirit of America which is to work and plan together. In spite of trials and tribulations, America will go on and on, even though progress is up and down like the waves of the ocean.

Many, many years have been spent by men dreaming of democracies. The Athenians had a democracy and then lost it. Rome rose and fell. It was this continuing determination on the part of men to find expression of their own liberty, to find expression of their own freedom of opportunity, and to find expression of their own initiative that was in the hearts of the men who came to America to establish a new way of life. Through trials and tribulations they sailed the tractless seas and founded this new country, this Land of Freedom. When they struck for liberty at Philadelphia, they adopted the Declaration of Independence, which alone tied our country together twelve years before a Constitution was established.

The Declaration of Independence is an important document. All of us agree to that. If I asked, "What do you know about the Declaration of Independence?" you would answer, "I know all about it; I learned about it in school. Why do you ask such a foolish question?" Then if I asked you to recite the Declaration of Independence, you might start off with the first few words, "When in the course of human events," and let your voice dwindle off into a mumble like we sometimes do when we try to sing "The Star Spangled Banner."

The point I want to make is this: If we could recite the last sentence of the Declaration of Independence, instead of the first sentence, we would have something. The meat of the Declaration that represents the very foundation of this great country is all in the last sentence, which consists of only twenty-two words. It is as short as a telegram, and yet there are probably few persons who can quote these last twenty-two words.

The Declaration of Independence was written by a thirty-three-year-old red-headed boy in a rooming house in Philadelphia. His name was Thomas Jefferson, and he epitomized in that document all of the thinking of that day and generation. He submitted it to Benjamin Franklin, who was then a man seventy years old, and Mr. Franklin made only a couple of minor changes. He submitted it to fifty-year-old John Adams, who made only a few changes. The meat of it is summed up in that last sentence, the first part of which reads as follows:

> "In support of this Declaration, with a firm reliance upon the protection of a Divine Providence. . . . ."

Here is something which has been overlooked in our prosperity. America has grown in 150 years to be the richest nation on the globe. It was founded by men who had faith. Everything in America goes back to the hearts and souls of those men who believed in God. This Declaration of Independence therefore established that point first.

To continue:

> "In support of this Declaration, with a firm reliance upon the protection of a Divine Providence, we mutually pledge *to each other*—" (note that we not only pledge but that we *mutually pledge*) "we mutually pledge *to each other*. . . . ."

This is the thing which has been forgotten. America was built because men worked together. Now what did they pledge? "We mutually pledge to each other our lives" (no one can pledge more than his life), "our fortunes" (that means taxes to the limit of endurance), "and our sacred honor." They went all-out—"our lives, our fortunes, and our sacred honor."

America was developed under this code. The privileges that have been ours have come to us because men struggled to bring it about. They did not just happen. Our forefathers worked shoulder to shoulder. America was built by this great spirit of understanding and cooperation. The whole theme of democracy lies in the need of each other.

The history of the world shows that human beings are pretty much alike. Once we become prosperous we very often release the need of Divine Providence. That is the pity of it. We also release the need of each other and think that we can "go it" alone. That is why Greece fell, and that is why Rome fell.

I read a story recently about Aquippa, one of the great Roman statesmen, who, in making a plea to the people of Rome for cooperation to save the Roman Empire, told them the old Aesop fable of "The Body and Its Members." I was familiar with Aesop's Fables, but did not remember this one. I hurried over to a bookstore to buy a copy, afraid that in the one thousand years from Aesop's time to the present, this particular fable had been "lost in the shuffle." I thumbed the book feverishly, and there it was.

As I read, I tried to visualize Aquippa pleading with this great Roman populace to forget the things they had been indulging in and get back again to the things that meant the solidarity of the Roman Empire, his appeal for cooperation, and his appeal for the need of each other. As I read further, I began to shiver a little because this was before the days of Pearl Harbor, when there was so much dissention in our own country.

This is the story. The hands and the mouth and the teeth one day got together and said, "We are doing all the work. We are feeding that lazy fellow, the stomach, and why should we feed him?" So the hands said, "You are right, we won't pick up anything," and the mouth said, "You are right, if you pick it up, I won't open my mouth to receive it," and the teeth said, "Yes, and if you take it in your mouth, I won't chew it. We will show that stomach where he gets off." They told the stomach what they had decided to do, and the stomach could not do very much about it. But you know what happened after two or three days. The hands began to palsy through lack of nourishment, the mouth was parched through lack of water, and I forget what happened to the teeth. The three of them held another meeting. They said, "My gracious, what is the matter? We are going to die unless we get nourishment, and the only way we can get nourishment is to feed the stomach because that is what brings us our nourishment." So the hands got busy, the mouth got busy, and the teeth got busy, and they fed the stomach. Then the stomach passed its nourishment back to them.

* Presented at the Forty-Fourth Annual Meeting, The American Ceramic Society, Cincinnati, Ohio, April 20, 1942 (General Sessions on War Emergency Problems). Received June 12, 1942.

This picture is a picture not only of ancient Rome but of modern America in disunity. Hands refusing to work. Change the analogy of the stomach to invested capital and business enterprise that build the payrolls of the country. Why, the thing that Aquippa was trying to tell was that no one thing is more important than another, that in the scheme of life we must have the combination, the rhythm, of each doing his part. That is the reason democracies are ascending in civilization and will ascend as long as we recognize our need for each other, a recognition that applies not only to our domestic relations but between nations as well. No nation can "go it" alone, and individuals cannot "go it" alone.

Under democracy we have had a taste of the thrill of freedom. If we lose these things that have taken many years to build up, we cannot charge it to our forefathers. We cannot lay it to our children and our children's children and to our grandchildren who come after us. The only people that can preserve democracy today are the adults of this day and hour. That is a challenge to each of us. There is no way to duck it. Either democracy will fall because of us or it will live because of us.

This star of destiny that floated over Egypt, then over Greece, and then over Rome, and, perhaps, in the last generation over England, has moved squarely over America. We did not ask for it, but it is there, and we have our job to do, not only to win the battle for democracy but to hold it and safeguard it.

With modern science and research and with the lines of communication that span the ocean in twenty-four hours, we can no longer live in isolation; we must learn through understanding our relative need of each other if world civilization shall endure.

But getting back to America. I like to picture the scenes in those old days when they were founding this nation. I can imagine our forefathers sitting there in Philadelphia saying, "Now what can we do to tell the American people who follow us how necessary it is to maintain certain foundation stones?" They clearly foresaw the time when it would be necessary for us to be jerked back again and again and put on the right track in the preservation of democracy. I can imagine that some man in the group said, "Mr. Chairman, I have an idea." Of course, they all turned to him, because ideas are priceless things. He continued: "Why not engrave on the money that we are going to mint the three things that we consider most fundamental in this great new democracy we have launched?" So from that day to this most of the coins that have passed through your hands have had three patriotic slogans engraved on them.

The first is the word "Liberty." Oh, what a price they paid for that liberty! So there is not one coin that does not have this priceless word stamped on it. Second, there is not a coin that does not have the words "E Pluribus Unum" stamped on it (Latin for "We pledge to each other, all for one"). In the original minting, this phrase was extended to read "All for one, without which nothing."

There is a third message on the coins—"In God we trust." They did not want us to forget that Divine Providence had a lot to do with the founding of America, although I am afraid that in our prosperity we have lost contact to some extent.

All America is marching straight forward today to preserve these things that mean so much, not alone for ourselves but for our children and children's children.

Great factories all over the country are stepping up their production, and the might of a great America is rising up, not to build a selfish world, but to translate the great cause of freedom to all humanity.

AMERICAN ROLLING MILL COMPANY
MIDDLETOWN, OHIO

—Security in Unity—
The American Ceramic Society
A Union of Fellow Ceramists

DOWELED MASONRY*

BY FREDERICK HEATH, JR.

Abstract

Clay cell plugs are described that may be used for shatter-resistant masonry with high compressive and transverse strength. These plugs can serve as a substitute for steel reinforcing.

I. Pilaster Tests

Tests were conducted at the Engineering Experiment Station of the Ohio State University, Columbus, Ohio, in 1929 as part of a research sponsored by the Structural Clay Tile Association. The object of the test was to investigate the strength of three different methods of reinforcing Heath Cube pilaster construction as compared with ordinary construction. Tests of this kind had not heretofore been made, and this series was designed to obtain a general idea of comparative strength rather than complete test data.

Four walls were constructed, each of which was similar except for the method of reinforcing the four major cells of the pilasters. The walls were built as shown in Figs. 1 and 2.

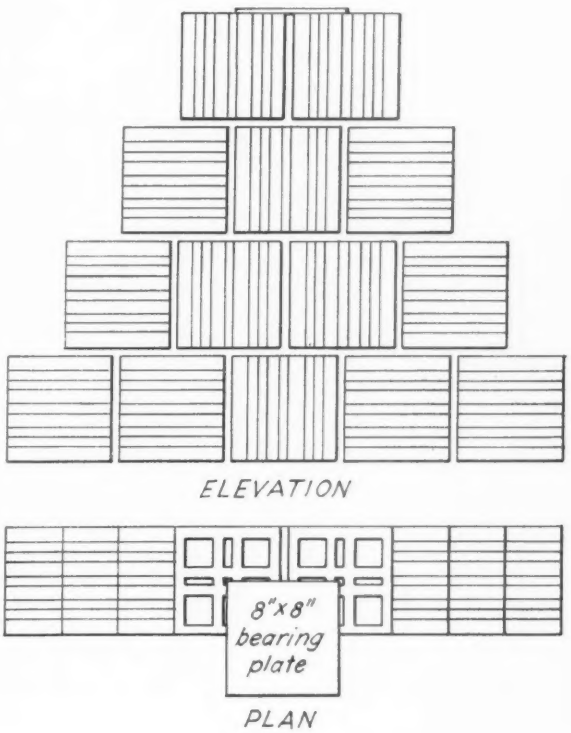

FIG. 1

Wall No. 1 was ordinary construction with no cell filling.

Wall No. 2 had cells filled with mortar (cells filled are indicated in diagram). The mortar mix was the same mix as used in laying the walls, but the prefilling was done about one week before the building of the walls.

* Presented at the Forty-Fourth Annual Meeting, The American Ceramic Society, Cincinnati, Ohio, April 22, 1942 (Structural Clay Products Division). Received June 11, 1942.

Wall No. 3 had cells grouted with thin mortar, and four $^3/_8$-in. round reinforcing bars, which extended continuously vertically through the four courses of the wall, were inserted in each cell. The mortar was allowed to settle for about two hours before the bedding of the bearing plate.

Wall No. 4 had 16 clay cell plugs, each of which was approximately $2^1/_4$ by $2^1/_4$ by 8 in. The plugs were placed in the cells after each course had been laid and were held in position by the mortar of the bed joints.

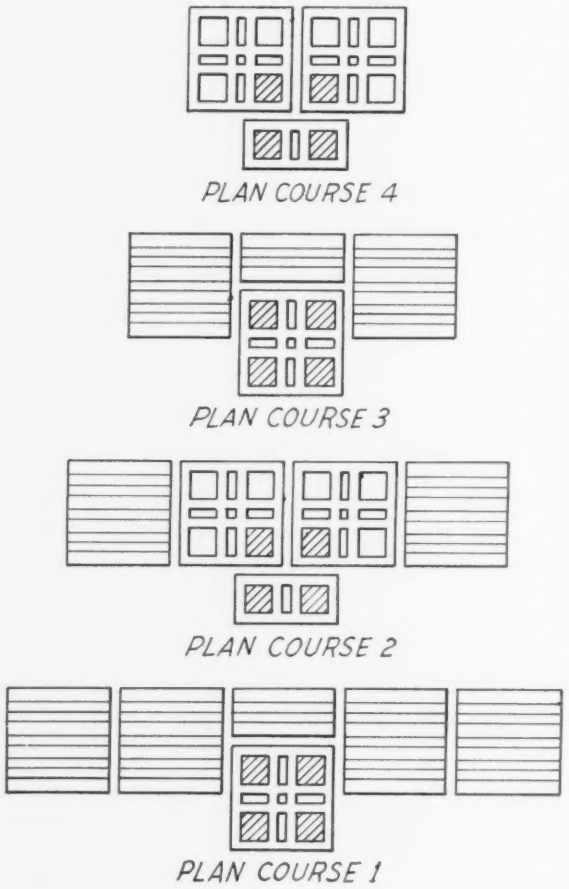

FIG. 2

Each wall was constructed in less than 20 minutes of actual mason's time. An additional 5 minutes were required to prefill the cells of wall No. 2, and 10 extra minutes were required to grout the cells and to place the reinforcing bars in wall No. 3. The bearing plates were $^1/_4$-in. boiler plate bedded at the time of construction (except as noted for wall No. 3). The walls were built January 22, 1929, and were tested one week later.

The Heath Cubes used were of the standard fire-clay grade made by the Nelsonville Brick Co., Nelsonville, Ohio. Tests of individual Cubes from the same lot showed that the Cubes used in the walls averaged 1000 lb. per sq. in. gross area on side and 3000 lb. per sq. in. gross area on end. The Cubes were carefully sorted so that the quality of the individual Cubes was similar in each wall. The mortar was one part Miami hydroplastic cement, $^1/_5$ part hydrated lime, and three parts sand. Mortar of this quality, in the form of 2- by 4-in. cylinders, tested approximately 1200 lb. per sq. in. at the age of one week.

The walls were tested in a 500,000-lb. capacity screw-testing machine. The load, applied at the rate of 0.05 in. per min., was transmitted through a spherical bearing block centered on the bearing plates, and the plates were capped with plaster of Paris to insure uniform load distribution.

TEST RESULTS

	Area loaded (in.²)	Total load ultimate (lb.)	Unit load (lb./sq. in.)
Wall No. 1			
Ordinary construction	64	66,900	1045
Wall No. 2			
Cells mortar prefilled	"	85,800	[illegible]0
Wall No. 3			
Cells grouted and bars	"	135,300	[illegible]
Wall No. 4			
Clay cell plugs	"	143,000	22[illegible]

In wall No. 2, the shells of the Cubes were forced out, apparently because of the lateral expansion of the mortar filling in the cells. Some of the shells spalled off in wall No. 3 and exposed the cell filling, and there were some voids where the grout had not completely filled the cells. The clay cell plugs used in wall No. 4 promise to be the most practical and effective means for reinforcing Heath Cube pilaster construction.

II. Use for Air-Raid Blast Masonry

The need for reinforcing walls to resist air-raid blasts suggests the staggering of these clay cell plugs to form dowels between the courses of tile (Fig. 3). A half-length

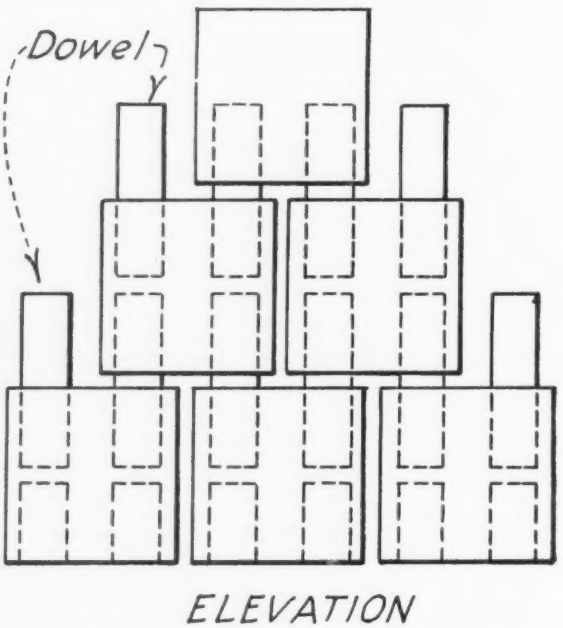

FIG. 3

dowel could be inserted in the bottom of the first course of tile; the full-length dowels would then interlock the units.

III. Tensile Strength

This type of wall structure would develop tensile strength and might be suitable for silos or storage bins without the need for metal reinforcing. Although excellent compressive properties are shown in these tests, the tensile properties have not been tested.

COLONIAL CLAYS, INCORPORATED
311 MAIN STREET
WORCESTER, MASSACHUSETTS

ACTIVITIES OF THE SOCIETY

EDITORIAL

A STUDY OF CERAMIC MATERIALS IN THE MINING SCHOOLS OF THE UNITED STATES*

By A. F. Greaves-Walker

For many years after the establishment of the Department of Ceramic Engineering at Ohio State University, Columbus, Ohio, the mining educators ignored the tremendous possibilities offered by the nonmetallic minerals and practically refused to recognize ceramic engineers as "nonmetallic engineers." This may have been due, to a large extent at least, to the fact that in the early days of ceramic education the educators confined their teaching almost entirely to clays and clay products.

During the past decade, there has been an abrupt about-face in the attitude of mining educators toward the nonmetallics or, as they call them, the "industrial minerals." As a result, the Industrial Minerals Division of the American Institute of Mining and Metallurgical Engineers has now become one of the strong professional divisions of that organization.

Practically all of this change of attitude was brought about by the intensive work on ceramic materials and processes which has been and is being conducted by the U. S. Bureau of Mines. The Bureau was literally "kicked out" of ceramics as such some years ago by a presidential executive order, and, as a consequence, it had to use some other term to cover its activities in the nonmetallics field. Most of the results of Bureau investigations conducted at its stations in Maryland, Missouri, Alabama, and Washington have been presented at the annual meetings of The American Ceramic Society and of the A.I.M.M.E.

Owing to closer contacts which have been made between the Institute of Ceramic Engineers and the Industrial Minerals Division of the A.I.M.M.E., joint meetings have been held during the past three years at Tuscaloosa, Alabama, Urbana, Illinois, and Rolla, Missouri. The attendance, however, of ceramic engineers, and particularly members of the Materials and Equipment Division of The American Ceramic Society, has been poor.

Although papers on the subject of equipment presented before the Materials and Equipment Division have been largely confined to what might be classed as clay equipment, many excellent papers describing research on crushing and crushers, grinding in ball and tube mills, screening, flotation and flotation equipment, and other methods of separation have been presented before the Industrial Minerals Division of the A.I.M.M.E. by members, manufacturers, and U. S. Bureau of Mines engineers. Many of these papers are of as much or even more interest to ceramic engineers than to mining engineers.

In spite of the increased interest of mining educators and mining men in ceramic minerals, not more than one to two per cent of the graduates of the mining departments are going into the ceramic field. The mining departments, as a rule, are devoting little time to the subject and are generally relying on the departments of geology to give the students what information they get in courses in economic geology. These courses generally confine themselves to a survey of the uses of the nonmetallic or ceramic minerals.

In some of the states having departments of mining engineering but no departments of ceramic engineering, large deposits of the nonmetallics exist, but there are few deposits of the metallic minerals, and there is often no coal. There appears to be an increasing interest in the nonmetallics in these departments, and a tendency to devote more time to them. This probably will result eventually in the addition of ceramic engineers to the teaching staffs. In Montana, which has rich metallic mineral resources, a ceramic engineer was added to the teaching staff of the Montana School of Mines several years ago to give ceramic courses to mining and metallurgical engineers.

As ceramic engineers will undoubtedly continue to increase their hold on the entire nonmetallic field, it would seem that the Materials and Equipment Division has a splendid opportunity to broaden its program to include all nonmetallics and the equipment necessary to process them. This should draw mining engineers, processors, and equipment manufacturers who now go elsewhere to give and to receive information. More important still, it would result in additions to our literature that would be of great value to many ceramic engineers.

Department of Ceramic Engineering
University of North Carolina
Raleigh, North Carolina

* Presented at the Forty-Fourth Annual Meeting, The American Ceramic Society, Inc., Cincinnati, Ohio, April 23, 1942 (Materials and Equipment Division). Received April 22, 1942.

Postwar Security Is Essential

There Must Be No Slacking in Ceramic Research and Education

THE AMERICAN CERAMIC SOCIETY, INC.,

Is Your Opportunity

MY RESPONSIBILITIES—MY JOB

I Am My Sole Competitor
I Equip My Mind and Practice My Talents
To Better Serve in the Vocation I Have Chosen

I Train My Body and My Personality
To Meet and to Work Agreeably with Others

I Seek to Extend and to Improve
Social and Intellectual Intercourse with Others
For These Purposes I Am a Working Member of

THE AMERICAN CERAMIC SOCIETY, INC.

PAID MEMBERSHIP RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
December 21, 1941	2029	257	37	609	220	3152
January 21, 1942	2043	254	38	600	220	3155
February 21, 1942	2083	255	34	605	220	3197
March 21, 1942	1780	240	49	355	220	2644
April 21, 1942	1836	244	45	361	220	2706
May 21, 1942	1883	251	37	371	220	2762
June 21, 1942	1923	252	32	373	220	2800
July 21, 1942	1947	253	27	391	220	2838

I am anxious to secure the assistance of more persons and corporations in this enterprise of self-betterment.

NEW MEMBERS FOR JULY

Corporation

*GLOBE BRICK CO., S. C. Porter (voter), East Liverpool, Ohio.

Personal

ALEXANDER, JOHN B., Southwestern Portland Cement Co., Xenia Ave., Osborn, Ohio; chief chemist.

BOLLINGER, ELDRED F., 319 Fulton, Redwood City, Calif.; chief chemist, Pacific Portland Cement Co.

CHESNY, H. H., Northwest Magnesite Co., Cape May, N. J.; chemical engineering consultant.

DAY, CHARLES M., 208 North Broadway, St. Louis, Mo.; vice-president, Valley Dolomite Corp.

DUMAS, MAXWELL G., 825-37 Behan St., N. S., Pittsburgh, Pa.; president, Steel & Engineering, Inc., and Allegheny Machine & Tool Works, Inc.

GARDNER, J. N., Algoma Steel Corp., Ltd., Sault Ste. Marie, Ontario, Canada; superintendent of bricklayers.

GRIGORIEFF, WLADIMIR W., Lenox, Mass.; laboratory section head, General Electric Co., Pittsfield, Mass.

HESS, RALPH F., JR., 500 Filbert St., Curwensville, Pa.; testing engineer, North American Refractories Co.

KLINE, HUGH L., 4107 Winchester Rd., Louisville, Ky.; engineer, Corhart Refractories Co., Inc.

LANTZ, RICHARD T., State St., Curwensville, Pa.; district engineer, North American Refractories Co.

*MCCARTY, J. E. D., Simmonds Aerocessories, Inc., Vergennes, Vermont; chief research engineer, Simmonds-Benton Mfg. Div.

MCDONALD, J. H., Algoma Steel Corp., Ltd., Sault Ste. Marie, Ontario, Canada; superintendent of open hearths.

MORROW, C. T., Northwest Magnesite Co., Cape May, N. J.; superintendent.

PORTER, SIDNEY C., Globe Brick Co., East Liverpool, Ohio; treasurer.

RODEFER, H. H., Box 550, Bellaire, Ohio; vice-president, Rodefer Glass Co.

ROFF, W. WALLACE, 14 Glenside Dr., West Orange, N. J.; vice-president, Whittaker, Clark & Daniels, Inc., New York, N. Y.

WEISZ, ROBERT S., Westinghouse Research Lab., East Pittsburgh, Pa.; research fellow.

Student

Ohio State University: ROBERT L. REED.

Pennsylvania State College: EARL T. MIDDLESWARTH AND CORNELIUS J. REAGAN.

University of Illinois: BERNARD KWATE AND FRANCIS P. SHONKWILER.

MEMBERSHIP WORKERS' RECORD

Corporation

R. E. Birch 1

Personal		Student	
R. E. Birch	10	A. I. Andrews	1
E. C. Petrie	2	R. L. Cook	1
Ralston Russell, Jr.	1	E. C. Henry	1
L. J. Trostel	1	N. W. Taylor	1
Office	3	A. S. Watts	1

Grand Total 23

ROSTER CHANGES DURING JULY†

Personal

ARRANCE, FRANK C., 123 North County Line St., Fostoria, Ohio (Risingsun, Ohio)

BAKER, JULIUS, 815 Delafield Place, N. W., Washington, D. C. (Columbus, Ohio)

BENNETT, MYLES P., 5088 Alhambra Ave., Los Angeles, Calif. (Temple City, Calif.)

BLUME, ARTHUR J., 1st Lt., Army Induction Board, 1250 Ontario St., Cleveland, Ohio (Peru, Ind.)

BRADWELL, CYRIL, 924 Timberman Rd., Columbus, Ohio (Toronto, Ontario, Canada)

BURNAND, GUY M., Messrs. Johnson, Matthey & Co., Ltd., 78, Hatton Garden, London, E. C. 1, England (New York, N. Y.)

CAREY, J. SHELDON, 474 Great Rd., Saylesville, R. I. (New York, N. Y.)

COX, PAUL E., Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa. (New Orleans, La.)

DAY, RALPH K., National Cash Register Co., Dayton, Ohio (Buffalo, N. Y.)

EARHART, WILLIAM H., Box 99, Niantic, Ill. (Columbus, Ohio)

ELLIS, JAMES L., 20 Young St., Apt. 2, Sudbury, Ontario Canada (Medicine Hat, Alberta, Canada)

FINN, ALFRED N., 1919 S. Twelfth St., Lincoln, Neb. (Washington, D. C.)

FOSTER, HARRY D., Box 731, Alfred, N. Y. (Columbus, Ohio)

Henderson, Frederick C., Royal China Co., Sebring, Ohio (East Liverpool, Ohio)

NEWTON, ROBERT L., 68 East Ave., Bridgeton, N. J. (Cleveland, Ohio)

PETERSEN, FRED A., Dept. of Ceramics, Univ. of Illinois, Urbana, Ill. (Westminster, Mass.)

POOR, MARY ELEANOR, 642 Jones St., San Francisco, Calif. (Kansas City, Mo.)

SHARF, J. M., Central Technical Labs., Armstrong Cork Co., Lancaster, Pa. (Washington, D. C.)

SMITH, HILLARD A., 291 Woodbridge Ave., Metuchen, N. J. (Cincinnati, Ohio)

SNYDER, ERNEST B., Apt. 15, 716 6th Ave., Columbus, Ohio (Bethlehem, Pa.)

SNYDER, RAY A., Stupakoff Ceramic & Mfg. Co., Latrobe, Pa. (Derry, Pa.)

SOMMERVILLE, Lt. J. L., 453d Engr. Co., Camp Pickett, Va. (Ft. Belvoir, Va.)

STUCKEY, ROBERT C., JR., 2d Lt., Signal Corps, Camp Evans, Belmar, N. J. (Washington, D. C.)

TEPPING, HERBERT, 1948 Rugby Rd., Dayton, Ohio (Murray, Ky.)

TOWNSEND, LESLIE W., Franklin Tile Co., Lansdale, Pa. (Maurer, N. J.)

WELCH, ARNOLD P., 1032 Colony St., Saskatoon, Saskatchewan, Canada (Toronto, Ontario, Canada)

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* Indicates former member rejoining.

† Address in parentheses is former address.

In 1941, $46,626.29 Was Collected and Expended By 2068 Personal and 258 Corporation Members of

THE AMERICAN CERAMIC SOCIETY, INC.,

To Promote Ceramic Research and Education by

(1) Holding Meetings and by Committee Activities

(2) Publishing Reports of Original Researches

(3) Abstracting World-Wide Literature of Interest to Ceramists.

This tax-exempt investment in postwar security should be shared by a larger number of Corporations at a minimum of $25 annually.

OUR MEMBERS IN SERVICE

Resolutions Unanimously Adopted by Board of Trustees

Resolved, That members of The American Ceramic Society, Inc., who were in good standing at the time of their entrance into the armed forces of any of the United Nations on or subsequent to January 1, 1941, shall be eligible for transfer to an inactive list and shall remain thereon until six months after they are mustered out of the service or until they are removed from the inactive list for any reason by action of the Board of Trustees.

That while on the inactive list the members shall be exempt from the payment of dues; their names shall be published regularly in the Membership Roster; and they shall waive the right to receive Society publications and the privilege of voting.

MINUTES OF CERAMIC EDUCATIONAL COUNCIL ANNUAL MEETING

The annual meeting of the Ceramic Educational Council was held April 19 and 20, 1942, in Cincinnati, Ohio. The first session was called to order at 7:20 P.M. on April 19.

In the absence of President C. W. Parmelee, Vice-President N. W. Taylor took the chair. The minutes were read and approved.

Chairman C. M. Dodd reported for the Committee on Distribution of Ceramic Courses in Ceramic Engineering and recommended that the Committee be disbanded. In view, however, of the probable changes arising from the accelerated program, the Committee was requested to stand by.

Chairman J. W. Whittemore reported for the Committee on Physical Chemistry. This report was discussed at length, but no specific recommendations in the form of motions were made.

Chairman M. J. Rice reported for the Committee on Substitution of Semimicroqualitative Analysis for Qualitative Analysis. Mr. Rice moved (seconded by M. E. Holmes) that the Council endorse the more extended use of semimicroqualitative methods for teaching qualitative analysis. The motion was carried.

Chairman E. P. McNamara reported for the Committee on Extension Work in Ceramic Education. The report was accepted.

Chairman J. L. Carruthers reported for the Committee on Contents of Ceramic Engineering Courses. A. I. Andrews moved (M. E. Holmes seconded) that this report be mimeographed and sent to all ceramic schools. C. M. Dodd moved to amend (seconded by A. F. Greaves-Walker) that the expense of mimeographing be charged to the fifty-dollar appropriation of the Council. The motion as amended was carried.

Chairman P. G. Herold of the Committee on Arrangements reported that he had arranged for an afternoon meeting but was given an evening hour without previous notice or consultation. The consensus of opinion was that too little time had been allotted, and various hours and dates for holding the session were discussed.

In view of the late hour, it was moved by E. C. Henry (seconded by E. P. McNamara) that the meeting adjourn until 8 o'clock Monday morning. The motion was carried.

The second session was called to order at 8:20 A.M., April 20.

Chairman N. W. Taylor asked for permission to bring up the problem of Student Branches and their relation to The Society and more particularly the question of visits to these Branches by the national officers. After some discussion, it was generally agreed that one or more of these officers would visit the schools if invited. E. P. McNamara moved (seconded by E. C. Henry) that the Council go on record as urging the national officials to pay more visits to local chapters and schools. The motion was carried.

A. I. Andrews, Chairman of the Nominating Committee, reported the following nominees:

For President: NELSON W. TAYLOR, Pennsylvania State College, State College, Pa.

For Vice-President: ROBERT M. CAMPBELL, New York State College of Ceramics, Alfred, N. Y.

For Secretary: CHARLES M. DODD, Iowa State College, Ames, Iowa.

The nominees were unanimously elected.

Chairman A. I. Andrews reported for the Committee on Student Employment. After a general discussion of the employment and draft problem, C. M. Dodd moved (seconded by A. F. Greaves-Walker) that the Ceramic Educational Council ask the Board of Trustees to request of the Selective Service Board that ceramic engineers be included with other engineers as being eligible for deferment. The motion was carried.

Chairman A. F. Greaves-Walker reported for the Committee on Summer Reading. On the motion of S. R. Scholes (seconded by J. W. Whittemore), the Committee was discharged.

S. R. Scholes moved (seconded by J. L. Carruthers) that the President of the Council appoint a committee of three from this group to serve under appointment from the Dean of the Fellows to consider compilation of the history of ceramic education. The motion was carried.

Lane Mitchell, Georgia School of Technology, Atlanta, Ga., and P. G. Herold, Missouri School of Mines and Metallurgy, Rolla, Mo., were nominated and elected to general Nominating Committees A and B, respectively.

The session adjourned at 9:20 A.M.

—R. M. KING, *Secretary*

REFRACTORIES DIVISION AUTUMN MEETING

Dearborn Inn, August 28–29, 1942

Geographical location: Dearborn, Mich.

Railroad facilities to Detroit: Pennsylvania, New York Central, Wabash, Grand Trunk, and Pierre Marquette railroads.

Transportation from Detroit to Inn (11 miles): Taxi from station approximately $2.40 to $2.50; five can ride for the price of one. Busses every ten minutes from west side of Detroit City Hall on Lafayette Blvd. to Dearborn. On corner of Oakwood Blvd. and Michigan Ave., take Veterans' Hospital bus or bus marked "Allen Park" direct to the Inn.

Auto transportation to Meeting: Good roads (close to Chicago district).

Inn facilities: Twin beds $4.00 per person; single beds $4.50 per person (only 30 rooms can be reserved).

Technical meeting room: Inn ballroom (will handle 200).

Bridge for ladies: Inn lounge (bridge only).

Friday night banquet: Inn ballroom, $2.25 per person plus tax.

Meals at Inn: Inn dining room; luncheon $1.25 and up, dinner $1.75 and up. Coffee Shop also available.

Golf: Dearborn Country Club $2\frac{1}{2}$ miles from Inn; Inn station wagon or taxis for transportation to and from golf course; approximately 50 cents each way. Golf course in fair condition and level. Green fees: Week days and Saturday $2.00.

Outside attractions: Greenfield Village and Ford Museum.

MICHIGAN-NORTHWESTERN OHIO SECTION

A meeting of the Michigan-Northwestern Ohio Section was held May 29 at the picnic grounds of the Macklin Co., Jackson, Mich. Short talks were given by T. J. McIntyre of the Macklin Company and by Ross C. Purdy, General Secretary of The American Ceramic Society, Inc.

—W. V. BLAKE, *Secretary-Treasurer*

James Robert Beam, Secretary, White Wares Division

Erwin Fassig Theobald, Secretary, Structural Clay Products Division

INTRODUCING SOME MORE OF OUR PRESENT-DAY WORKERS

★ ★ ★ ★

Dwight Garrison Moore, Secretary, Enamel Division

★ ★ ★ ★

CITATION AWARDED TO CARL H. LAWSON BY WALTHAM CHAMBER OF COMMERCE*

May 16, 1941

"To Carl H. Lawson, for his intensive study and research in the field of industrial ceramics, which has resulted in great improvements in the form and quality of grinding wheels.

"As a result of this study and research, the Waltham Grinding Wheel Company has been able to assume a position of leadership in this important field of industry.

"Recognizing the importance of this research, we are happy to present this citation to Carl H. Lawson in behalf of the Waltham Chamber of Commerce."

---

* Mr. Lawson died on May 4, 1942. A notice of his death was published on p. 133 of the July, 1942, *Bulletin*

FORTY-FOURTH ANNUAL MEETING INCOME AND EXPENSES

Income		
Registration	$3773.50	
Tuesday night dance	748.87	
Enamel luncheon	68.37	
Glass luncheon	118.68	
Refractories luncheon	170.28	
White Wares luncheon	20.80	$4900.50
Expenses		
Badges	$ 127.78	
Lettering badges	78.25	
Publicity for meeting	32.45	
Telegrams	173.42	
Postage	46.63	
Long-distance calls	38.25	
Printing registration cards	27.83	
Lettering signs	20.60	
Lantern slides	10.48	
Local Committee	1130.44	
Printing tickets for dance	5.75	
Handmade Life Certificate	9.27	
Binding membership receipts book	1.00	
Staff traveling and hotel expenses	218.09	
Rental of projector	50.00	
Printing programs, reprints, and preprints	756.65	
Express	25.74	
White Wares luncheon	43.60	
General Secretary expenses	111.42	
Board of Trustees luncheon	90.92	
Reporting (Mrs. Ely)	219.12	
Tuesday night dance	682.38	
Enamel luncheon	68.37	
Glass luncheon	118.68	
Refractories luncheon	170.28	
Service boys	223.33	
Student Speaking Contest	30.00	
Hotel boys (service charges)	43.00	$4553.73
		346.77

Registration Attendance

709 men at $5.00	$3545.00
99 students at $1.50	148.50
80 ladies at $1.00	80.00
888	$3773.50
25 men complimentary	
913	
5 ladies complimentary	
918	

NATIONAL EMERGENCY STEELS

A Symposium promulgated by the War Production Board to use American alloying metals to best advantage and to conserve the scarcer imported metals has been published by the American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio. This Symposium, which costs 25 cents per copy, is in its fourth printing and has been revised once.

Foreword to Symposium

Notice was broadcast to American engineers early in 1941 that the available nickel, even though Canada is the principal producer, would be insufficient to meet all demands, and consumers were urged to use substitutes. In intervening months, the demands for alloy steels for armor, projectiles, guns, engines, gears, tools, and an infinite variety of machine parts (not only for the American forces but for lend-lease commitments) have brought on a similar shortage in all the alloying elements. Alloy steel is still needed by the millions of tons. Fortunately for this emergency, American metallurgical art and science has advanced to a point where the specific effect of each alloying element in steel is precisely known, and it has been discovered that in correct and balanced combinations each element intensifies the action of the other, so making it do double duty. Hence it is possible to "design" an alloy steel with confidence that it will perform as expected. Such steels have now been so formulated.

These new complex, low alloy steels known as the NE 8000 series were not picked out of thin air. They were designed with unanimous approval of the world's leading metallurgists, both steelmakers and steel users. They are already in production. Hundreds of heats of NE 8000 steels have already been made and their performance checked, and thousands of heats of series 4000 steels have been used with entire satisfaction by the automotive industry since 1935. All users of alloy steels are therefore urged to put them in production. Get trial lots from your regular steel supplier or warehouse immediately. Your production is important; true, it has unique aspects; nevertheless the new steels cover a wide range of properties and can be relied upon. They must be used, for every delivery of alloy steel after June 1, 1942, must be approved by the Director of Industry Operations of the War Production Board.

TREASURY OF SCIENCE

Complete Scientific Library

This is to be a new series of low-priced ($1.25), pocket-size books designed to serve the student and the intelligent reader by dealing authoritatively with varied aspects of modern scientific knowledge. The authority and reliability of each book will be assured by a Board of Editors which now includes Alvin Johnson, director of the New School for Social Research, Harlow Shapley of Harvard University, and Alfred E. Cohn of the Rockefeller Institute. Their selection of subjects and authors and their approval of the texts promise to establish this series as a major contribution to the educational forces in American life.

Because popularizations cannot adequately convey the latest scientific findings and interrelationships in our rapidly changing world, there is an increasing need on the part of students, of men in the armed forces, and of those in civilian life for substantial and standard scientific literature presented expertly but not pedantically and available at a moderate price. It is the hope of the publishers that the Treasury of Science will serve that need and will emerge as a landmark in contemporary education.

In general, the plan is to have the volumes written by authoritative scholars. The volumes are not to be textbooks nor are they to have many footnotes or references. They are to be written abreast of the level of knowledge and to include as much of the history of the subjects as to make their contemporary position understandable. The object is to make these books the best general statement for students and for the reading public interested in the sciences and ready to devote intellectual effort to their understanding. They would be introductory volumes to their subjects, but it is not the intention to talk down but rather to communicate in a free and lively style.

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Correspondence on manuscripts is invited. Please write to Treasury of Science, L. B. Fischer Publishing Corp., 381 Fourth Ave., New York, N. Y.

NOTES FOR CERAMISTS

CANCELLATION OF ILLINOIS MINERAL CONFERENCE

Owing to war conditions and the fact that the American Institute of Mining and Metallurgical Engineers is holding a regional conference in St. Louis, Mo., on October 1 and 2, it has been deemed advisable to cancel the Illinois Mineral Industries Conference, previously scheduled for October 30 and 31, 1942, under the sponsorship of the Illinois Mineral Industries Committee, the Engineering Experiment Station of the University of Illinois, and the Illinois State Geological Survey.

The St. Louis conference of the A.I.M.M.E. will stress conditions and problems of the Mississippi Valley area in general, and it is felt that the needs of the national situation will be better served by the concentration of time and effort on the one meeting.

—M. M. LEIGHTON, *Chief, Illinois State Geological Survey*

WILLIAM C. CRESS JOINS ARMOUR STAFF

Harold Vagtborg, director of the Armour Research Foundation, Chicago, Ill., has announced the appointment of William C. Cress, Mansfield, Ohio, as ceramist in the Metallurgy Division. Mr. Cress, who has been assigned to the study of the development of molding materials for ferrous castings, is rejoining the staff after having served for a year as ceramic engineer with the Carnegie-Illinois Steel Corp., Chicago, Ill.

E. W. Ritter

E. W. RITTER, ASSISTANT TO PRESIDENT, CORNING GLASS WORKS

E. W. Ritter has resigned as vice-president in charge of manufacturing and production engineering of the Radio Corporation of America Mfg. Co., Inc., to become assistant to Glen W. Cole, president of the Corning Glass Works, Corning, N. Y. Mr. Ritter will be actively engaged in development, engineering, and manufacturing matters relating to war products.

Biography

Mr. Ritter was born in 1902 in Indiana. Following his graduation from Purdue University in 1925, where he received a degree in electrical engineering, he became associated with the Engineering and Development departments of the General Electric Company. In 1930, he entered the employ of the RCA Mfg. Co., where he served in the Development Department at the Harrison, N. J., plant and as manager of the Harrison Works, Harrison, N. J., before becoming vice-president in charge of manufacturing and product engineering for all of the RCA plants.

Mr. Ritter is a member of the Army Ordnance Society, the Society of Naval Engineers, the Institute of Radio Engineers, the American Association for the Advancement of Science, and the American Physical Society.

Buy Bonds and Salvage Materials
But First of All Keep Fit to Cope
With Daily Job Problems
Thus Wars Are Won and Security Attained

FUNCTIONAL DESIGN*

By C. M. Harder

Abstract

The background of present-day design and its influences on ceramic art are discussed. "Function" in design is not a modern discovery. "Style" is an outgrowth of environmental factors and not primarily an arbitrary fad.

I. Introduction

(1) Modern Changes

About ten years ago, Richard Bach of the Metropolitan Museum of Art gave an address before The American Ceramic Society in which he predicted rapid changes in the design of industrial products.[1] At subsequent meetings of the Art Division, Joseph Sinel[2] and other industrial designers reaffirmed this prophecy in discussing some of the practical problems of their profession. In the meantime, design transformations have occurred in many things, particularly in vehicles and in home furnishings.

A few imaginative and farsighted men whose work, based on sound design, represents creative experiments of the highest order, have been at the heart of the movement. Some of the articles produced during this time have been awkward affairs whose novelty has been their principal virtue, and they have died young. Others have been more or less successful attempts to follow what appeared to be the style of the moment.

Various names have been given to the new style, e.g., "modernistic," "functional," "streamlined," and "contemporary," and, taken collectively, it represents attempts to adjust to the rapidly changing times.

The public was at first unresponsive and is still skeptical, despite the fact that three prolonged mass exposures at world's fairs have done much to wear down its resistance. Some of the new products have undoubtedly been just as bad in their own peculiar way as the best examples of 1880. This, and the fact that choice bits of modernistic, General Grant, and Louis XVI have been often called upon to keep close company, has tended to cause a slight sense of confusion, insecurity, and suspicion on the part of the average person.

(2) Influence of "Function"

"Function" in design is not new. The average person is conservative and practical and sooner or later manages to get just about what he needs. It is to this spirit of caution that he owes his very existence. There was a time when pottery had to hold his food and water securely and his weapons and tools had to be dependable. When he found that an article was successful and did its work willingly and easily, he grew fond of it and spent his leisure time in refining its form and enriching its texture until the sight of it filled him with a feeling of pride and security. He did not know that he had created a work of art; he only knew that it was his and that it was good.

Man's security is no longer a matter of pots and axes, but he looks at a fighter plane in much the same old way. A plane is beautiful because it looks like what it is, and yet it is 100% engineering-aerodynamics. It is not strange that the principles of aerodynamics fail to arouse a proportionate enthusiasm when they are applied, for instance, to a teapot.

II. Mechanical Product Does Not Eliminate Art

With all due allowance for social conditions, the art profession is partly responsible for much of the existing confusion regarding art and utility. Two hundred years ago, the average artist was the keystone of the social order, a hard-working artisan and craftsman, trained through years of apprenticeship in the use of materials and in the making of articles of trade and commerce, many of which were a high form of art expression. A few persons who possessed the necessary skill and imagination worked as architects in the design and decoration of public buildings, churches, and homes. Although the coming of mechanical production did not eliminate the artist and craftsman altogether, it did deprive them of their natural place. So, partly in self-defense, they separated art from daily life. It came to have little to do with common things, and they began painting easel pictures which were put into museums.

A few of them sensed that they had lost their way, so they revived the art of earlier days and misapplied it to their own needs, adding further to the general chaos. And little attention has been paid to those who protested against this fumbling.

Nearly fifty years ago, the first of these prophets, Louis Sullivan, announced that "form follows function." Frank Lloyd Wright added corollaries about the influence of tools and materials and ably demonstrated his thesis. Neither of these men advocated arbitrary "isms." The principles by which they worked were basic truths of design common to all good creations in all periods and were related to the natural laws of adaptation and survival.

It is not radical to assume that the form of an article should be adapted to its use or that clay, glass, wood, metal, steel, concrete, and other materials have certain natural properties which prescribe the limits and manner of their usefulness. It can be seen, furthermore, that tools and methods of making will exert a powerful influence on final appearance.

Some confusion is understandable when this broad philosophy is applied to (1) the individual problems of ceramic design, representing professional and nonprofessional activities, (2) small shops and large units of the industry, and (3) teachers, students, amateurs, craftsmen, industrial designers, and plain potters. Among the teachers, there

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* Presented at the Forty-Third Annual Meeting, The American Ceramic Society, Baltimore, Md., April 1, 1941 (Art Division). Received April 2, 1941.

[1] R. F. Bach, "Quality Production," *Bull. Amer. Ceram. Soc.*, **11** [6] 149–52 (1932).

[2] Joseph Sinel, "Design Impels Consumer Response," *ibid.*, **13** [11] 291–92 (1934).

are varying educational objectives. Among the professionals, there are varying merchandising objectives. And everywhere the equipment ranges from the most primitive hand methods to the most recent mechanical devices. Raw materials vary from crude unwashed clay to the most highly refined products. The functional requirements of a piece of pottery, furthermore, although most important, are not so complex as those of architecture. Despite diverse objectives, all ceramic artists have two important things in common: (1) They are all subject to the influence and conditions of their time, and (2), no matter what they call themselves, they are all engaged directly or indirectly in the very old business of designing and producing ceramic vessels and decorative objects and are thus on common ground with all the potters in history.

III. Materials and Tools

Although a long, rich ceramic tradition is not altogether an unmixed blessing, it has provided abundant examples of the inherent qualities of clay. Throughout thousands of years, the artistic survival and quiet dignity of rich, full-bodied, plastic forms can be contrasted with the temporary nature of novelties, whose makers were not in sympathy with the real personality of clay.

This is by no means a plea for the wholesale imitation of Chinese, Persian, and primitive potters, even if that were possible. But their understanding of the fundamentals of their medium was such that it cannot be overlooked. This is not so simple as it may appear, as the real personality of any material can only be understood by repeated creative work in the medium itself. The Sung potters *worked* at their craft.

By chemical and physical means, the modern potter can impart, in a short space of time, properties which formerly required weeks and months of hard labor. The creative possibilities of glaze materials and modes of decorating have been only partially explored. The accumulated technical experience of thousands of specialized workers is available. Every material has, by reason of its physical properties, its resistance, its durability, and its texture, grain, and hardness, certain functions which it can and will carry out easily and gracefully. Whatever the material or approach, an understanding of this character is essential to sound design. Plasticity is one of the distinguishing features of clay.

Actually, it is possible to make almost anything of clay. Temporary models and lifelike imitations of nature demonstrate this fact. In such cases, the clay is often ignored. It is a means to an end, and its personality and qualities contribute little to the result, which may be either a reproduction of nature or only an intermediate stage on the way to final expression in some other material.

Design and making are but two sides of the same thing. "Making" involves methods of work, tools, and skill and experience in bringing about a definite result in terms of the effect of these things on materials. Clay can be worked in the dry, plastic, or fluid state. It can be shaped by pressing, casting, spinning, extrusion, and by hand molding. As each of these methods of forming is possible only within certain limits, its effect on design is obvious. Subsequent operations, manipulations, processes, and tools will also exert their own peculiar influences on the final result. The bringing together of all of these varied limitations would be a simple and logical procedure if they could be solved separately. But they cannot. They are interlocked and interdependent and must be solved together and each must bear its proper relationship to all the others.

IV. Quantity Production vs. Craft

Since the days when William Morris tried unsuccessfully to revive the outward aspects of the handicraft age, artists have been uneasy at the sound of the word "production." The words "mass-produced" have been used to convey the idea of total lack of art (whatever the then current definition of art happened to be). The general dismay over quantity production and the firm conviction that no artistic good could come from the machine have been widespread and understandable.

The disfranchisement of the artist and his loss of contact with materials, the futile attempts of the machine to reproduce the style, craftsmanship, and infinite variations of handmade things, and the changing social conditions foreseen by Morris were all contributing factors.

Insofar as the pottery industry is concerned, the basic principle of quantity production, which is the division of labor, was known and practiced six hundred years ago by the potters of King-te-chen, who were able to retain a high ideal in terms of craftsmanship and creative quality. Although this ideal persisted longer in the pottery industry than in most of the others, its eventual decline was inevitable under existing conditions. The press of competition, with its increasing demands on speed of production, was not accompanied by proportionate changes in shaping methods. Pottery was still made by individual hand operations. When the industry began to adopt new tools for true mass production, the change came at the wrong end first. Among the first of these changes was the tunnel kiln, which lowered the cost and increased the speed of firing finished ware. The methods of shaping, however, remained essentially the same. Many new and automatic tools, such as completely automatic shaping machines, automatic sprayers, banders, and many other devices for feeding ware in an uninterrupted stream through kilns that never cool, have been introduced in the past decade.

If this prospect is discouraging to artists, the improvement that has been made in ware design in the last decade may be considered. Articles produced in quantity must obviously be simple in form and must make the most of texture and color. All of the designer's resources must be used with telling effect. Sometimes months of creative activity are necessary before production is started. Every factor must be considered, each operation subjected to careful study, and innumerable experimental solutions tried on a small scale, as the mistakes of a designer for mass production cannot be quickly erased. In the larger plants, the creative work is done by one or two designers in collaboration with specialists in many fields. They must possess a different set of talents from those of the average handcraft artist. To coordinate design and production, their creative experience with ceramic materials must be supplemented with a high degree of engineering, organizing, and business ability.

The limitations on ceramic designers vary with the methods of production and merchandising and are never

quite the same for two situations. Smaller organizations with less mechanized equipment, who cater to a smaller market, produce more varied lines. The output of individuals and one- and two-men shops may be extremely varied and must therefore be sold in a still smaller market and for higher prices. Although the limitations and approach vary in each case, the fundamentals remain the same. Each designer has only his purpose, the tools at his command, and an understanding of his material. Each has a problem in design, and good design is just that, wherever it is found.

V. What Is Style?

The fertilizing effect of so many varied activities in ceramic work will be of immeasurable benefit. The work of one designer will influence that of another, and all will reflect the style of the time. The outlines of that style are being drawn in now, and, regardless of the name by which it is called, it is still just a mirror which reflects the solution of everyday problems.

Style has always been just that. The great styles of the past were not evolved as an arbitrary fancy. They were the natural way of working in that time and in that particular place. They represented the complex interaction of tools, materials, and methods of working translated into the demands of the time. Style is often confused with temporary fashion or fads. It is, however, of much deeper significance. It comes from within and is unavoidable and ever-present. It reflects at all times the depth of our understanding and control of materials, methods, and tools. Whenever these factors are handled properly, a good style is evolved. It may be that of an individual, a factory, or a whole people. Details may differ, but all will be caught up in the flavor of the time. The characteristic mark of a good style is sincerity of expression.

VI. "Abstract Design" and "Function"

Pottery is both a useful and a decorative craft. From the beginning, clay has been used for all manner of imagery, representation, symbolism, personal adornment, and social comment. Many of these have had a definite use and many were just the potter's fancy. Some of these rate as a high form of expression.

The gourds and shells which preceded pottery were probably carefully selected to serve as containers, but even they were put to decorative uses and their well-learned forms were retained when clayware came into use. Clay pots symbolizing animal and vegetable forms are a part of the cultural inheritance of every race. Fusion of the decorative and the useful is common to all creations. Even those made without any thought for the decorative may achieve this quality, as by accident, by reason of their thorough adaptation of form to purpose. The perfect fusion of form and use is the basis of design. Around that golden mean, the great and lasting things of the past have been created. On one side is immaturity; on the other is decadence.

Pure abstract beauty can be created in any medium and without regard to use. Problems of this kind are a valuable creative exercise to the artist. If successful, they may have a high esthetic value, and a great many people will be able to share the experience. But even some of these will ask what it is for, what it is supposed to be, and some of the more timid will just wonder. The situation is familiar and the conflicting emotions on both sides are natural reactions. Even children identify their creations with something. Every person is surrounded by abstract lines, forms, and symbols to which he has become accustomed through long association and which are never questioned. He does not remember that they once had some very real meaning.

Perfectly functioning forms occur everywhere in nature as a result of evolutionary processes. When man undertakes the job, however, he must work at it, and when once he has succeeded he is proud of the result and will retain at least some features of it as long as he can.

Many old forms still retain their traditional purpose or meaning after hundreds of years of use and have, by a kind of patient evolution, arrived at a high degree of perfection. This has been accomplished by the hands of generations of craftsmen, each intuitively or otherwise adding his contribution toward the final result. Some pottery forms and many hand tools possess this quality of finality. It is a kind of authentic beauty which is always present when form and purpose are happily balanced.

To achieve this quality in design is a noble ideal, and it can only be approached by a recapitulation of this evolutionary process. It proceeds with great effort from countless trials, experiments, observations, and, above all else, from intuition and creative ability. If experimental art is now enjoying a field day, it is because of the sudden awareness of the amount of outworn paraphernalia extant.

Not all pottery forms, however, are outworn. Some of them are the accumulated work of a multitude of designers over hundreds of years and have been proved in the laboratories of many generations of actual use. As long as they retain their significance, they can stand unashamed in the presence of any style or "ism."

Every person respects an object which does its job and which looks as if it enjoyed the process. These things, or reminders of them, will be kept long after their usefulness has past, thus providing work for future "modern designers."

Ceramic Art Department
New York State College of Ceramics
Alfred, New York

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Mosaic Tile Company, Zanesville, Ohio
Mount Clemens Pottery Co., Mount Clemens, Mich.

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National Gypsum Co., Clarence Center, N. Y.
National Industrial Sand Assn., Washington, D. C.
National Lead Co., Brooklyn, N. Y.
National Lime and Stone Co., Findlay, Ohio
National Sales Corp., Cincinnati, Ohio
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New Jersey Porcelain Co., Trenton, N. J.
New Jersey Pulverizing Co., New York, N. Y.
North American Refractories Co., Cleveland, Ohio
North Carolina Feldspar Corp., Erwin, Tenn.
Norton Company, Worcester, Mass.

Ohio Clay Co., Cleveland, Ohio
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Old Hickory Clay Co., Paducah, Ky.
Olean Tile Co., Olean, N. Y.
Onondaga Pottery Co., Syracuse, N. Y.
Orton, Edward, Jr., Ceramic Foundation, Columbus, Ohio
Owens-Corning Fiberglas Corp., Newark, Ohio
Owens-Illinois Pacific Coast Co., San Francisco, Calif.

Pacific Clay Products, Los Angeles, Calif.
Pacific Coast Borax Co., New York, N. Y.
Pacific Tile & Porcelain Co., Los Angeles, Calif.
Paper Makers Importing Co., Inc., Easton, Pa.
Pass & Seymour, Inc., Solvay, N. Y.
Pearson, E. J. & J., Ltd., Stourbridge, England
Pennsylvania Pulverizing Co., Lewistown, Pa.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Pfaudler Company, Rochester, N. Y.
Pittsburgh Plate Glass Co., Creighton, Pa.
Polaroid Corp., Cambridge, Mass.
Porcelain Enamel & Mfg. Co., Baltimore, Md.
Porcelain Metals Corp. of Louisville, Louisville, Ky
Porcelain Products, Inc., Findlay, Ohio
Portsmouth Clay Products Co., Portsmouth, Ohio
Potters Supply Co., East Liverpool, Ohio
Precision Grinding Wheel Co., Philadelphia, Pa.

Quigley Company, Inc., New York, N. Y.

Ramtite Co., Chicago, Ill.
Ransome Concrete Machinery Co., Dunellen, N. J.
Remmey, Richard C., Son Co., Philadelphia, Pa.
Republic Steel Corp., Youngstown, Ohio
Riddell, W. A., Co., Bucyrus, Ohio
Roseville Pottery, Inc., Zanesville, Ohio
Ross-Tacony Crucible Co., Philadelphia, Pa.
Rundle Manufacturing Co., Milwaukee, Wis.
Rustless Iron Co., Ltd., Keighley, England

Safety Grinding Wheel & Machine Co., Springfield, Ohio
Schundler, F. E., & Co., Inc., Joliet, Ill.
Seagram, Joseph E., & Sons, Inc., Louisville, Ky.
Shenango Pottery Company, New Castle, Pa.
Simonds Worden White Co., Dayton, Ohio
Smith, A. O., Corp., Milwaukee, Wis.
Smith & Stone, Ltd., Georgetown, Ontario, Canada
Solvay Process Company, Syracuse, N. Y.
Spinks, H. C., Clay Co., Newport, Ky.
Square D Company, Detroit, Mich.
Standard Brick and Tile Corp., Evansville, Ind.
Standard Porcelain Enamel Co., Philadelphia, Pa.
Standard Sanitary Mfg. Co., Louisville, Ky.
Star Porcelain Co., Trenton, N. J.
Stark Brick Co., Canton, Ohio
Stauffer Chemical Co., New York, N. Y.
Steele, J. C., & Sons, Statesville, N. C.
Sterling Grinding Wheel Co., Tiffin, Ohio
Structural Clay Products Institute, Washington, D. C.
Stupakoff Laboratories, Inc., Latrobe, Pa.
Summitville Face Brick Co., Summitville, Ohio
Sur Enamel & Stamping Works, Ltd., Calcutta, India
Surface Combustion Corp., Toledo, Ohio
Swindell Brothers, Baltimore, Md.
Swindell-Dressler Corp., Pittsburgh, Pa.

Taylor, Smith, & Taylor Co., Chester, W. Va.
Texas Mining & Smelting Co., Laredo, Texas
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Trenton Potteries Co., Trenton, N. J.
Tyler, W. S., Company, Cleveland, Ohio

Union Electrical Porcelain Works, Inc., Trenton, N. J.
United Clay Mines Corp., Trenton, N. J.
United Glass Bottle Mfrs., Ltd., London, England
United States Gypsum Co., Chicago, Ill.
Universal Clay Products Co., Sandusky, Ohio
Universal Dental Co., Philadelphia, Pa.
Universal Sanitary Mfg. Co., New Castle, Pa.

Vanderbilt, R. T., Company, New York, N. Y.
Vereeniging Brick & Tile Co., Ltd., Vereeniging, Transvaal, South Africa
Vesuvius Crucible Co., Swissvale, Pa.
Victor Insulators, Inc., Victor, N. Y.
Vitrefrax Corporation, Los Angeles, Calif.
Vitreous Steel Products Co., Cleveland, Ohio
Vitro Manufacturing Co., Pittsburgh, Pa.

Wallace China Co., Ltd., Huntington Park. Calif.
Washington Porcelain Co., Washington, N. J.
Wayne Laboratories, Waynesboro, Pa.
Western Brick Co., Danville, Ill.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Derry, Pa.
West Virginia Brick Co., Charleston, W. Va.
Wheeling Steel Corp., Yorkville, Ohio
Wisconsin Porcelain Co., Sun Prairie, Wis.

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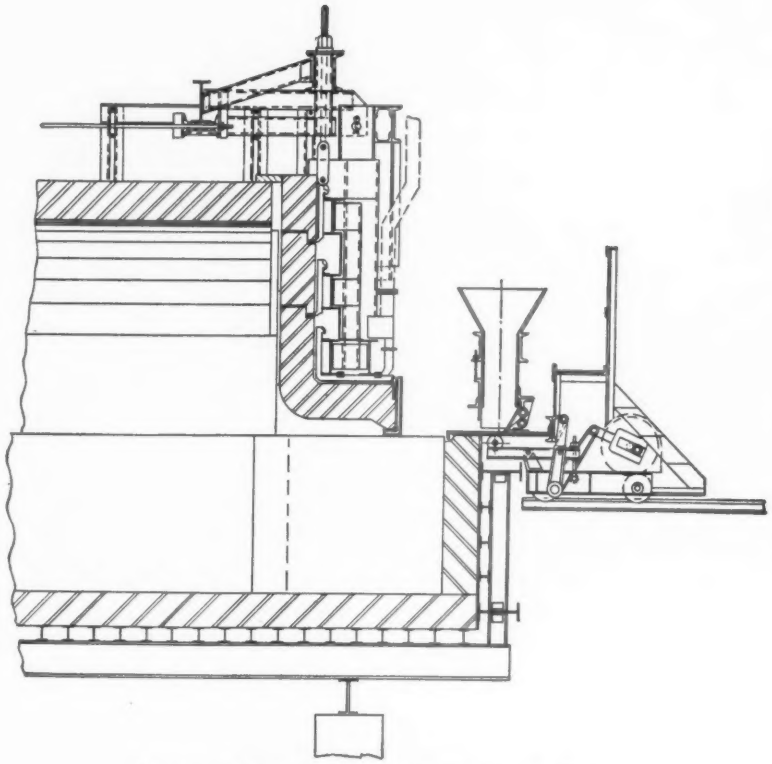

Sideview of Charger, Batch Hopper, Covered Doghouse, Suspended Backwall, etc.

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Electro Refractories & Alloys Corp.
The Hommel, O., Co., Inc.
Norton Co. (*Alundum-Crystolon*)

Air Conditioning Systems
Frazier-Simplex, Inc.

Aloxite (Refractory Products)
Carborundum Co.

Alumina (Hydrate and Calcined)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Alumina (Fused) Brick and Tile
Electro Refractories & Alloys Corp.
The Vitro Mfg. Co.

Aluminum Oxide (Calcine)
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Aluminum Oxide (Fused)
Carborundum Co.
Electro Refractories & Alloys Corp.
Foote Mineral Co.
Harshaw Chemical Co.
Norton Co.
The Vitro Mfg. Co.

Alundum (Refractory Products)
Norton Co.

Ammonium Bicarbonate
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Solvay Sales Corp.

Ammonium Bifluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Ammonium Carbonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Antimony Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Antimony Sulphide
Foote Mineral Co.
The Hommel, O., Co., Inc.

Arches (Interlocking, Suspending, and Circular)
Frazier-Simplex, Inc.

Arsenic
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Automatic Brick Car Loaders
Lancaster Iron Works, Inc.

Ball Mills
The Hommel, O., Co., Inc.
Inc.
McDanel Refractory Porcelain Co.
The Vitro Mfg. Co.

Ball Mills (Laboratory Type)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Barium Carbonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Basic Oxides
Porcelain Enamel and Mfg. Co.

Batch Systems
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Batts
Carborundum Co. ("*Carbofrax Aloxite*")
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Beryl
Foote Mineral Co.

Bichromate of Soda
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Bitstone
Potters Supply Co.

Blocks (Refractory)
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Louthan Mfg. Co.
Norton Co.
The Vitro Mfg. Co.

Body Stains
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel, O., Co., Inc.

Bone Ash
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Borax
American Potash & Chemical Corp.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Borax Glass
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Anhydrous)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. ("*Carbofrax Aloxite*")
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Cadmium Sulphide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Solvay Sales Corp.

Caustic Soda
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Cements
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pennsylvania Salt Mfg. Co.

Ceramic Chemicals
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Cerium Oxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.

Chromium Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Ball)
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.
The Vitro Mfg. Co.

Clay (Bentonite)
Foote Mineral Co.

Clay (Block)
Du Pont de Nemours, E. I., & Co., Inc., R. &. H. Chemicals Dept.

Clay (China)
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.
The Vitro Mfg. Co.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

Clay (Electrical, Porcelain)
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Enamel)
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Metal & Thermit Corp.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
Titanium Alloy & Mfg. Co.
United Clay Mines Corp.
The Vitro Mfg. Co.

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If you are changing over or considering how your furnaces can be utilized in the war program, we suggest that you use the engineering service Carborundum offers. The use of the right super refractory and its proper installation are highly important aids to increased production—reduced operating costs—turning out more uniform materials and products.

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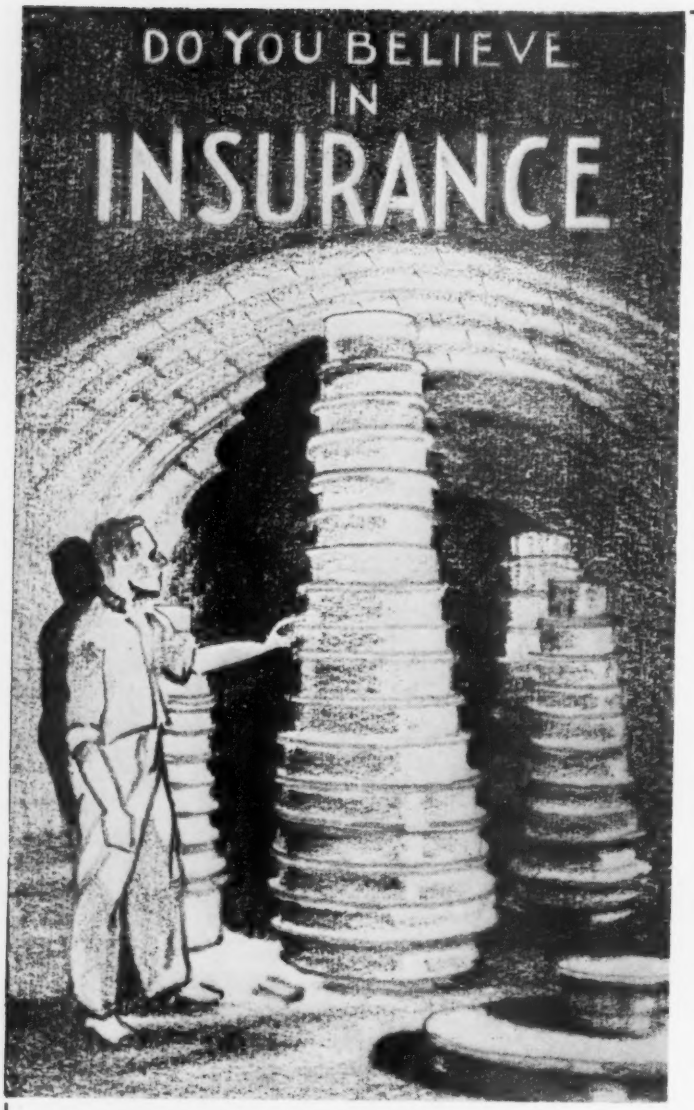

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THE complete dependability of Orton Pyrometric Cones is your best protection against firing failures. And don't let the low cost of these cones fool you for a minute. Orton Cones, throughout the complete manufacturing process, are rigidly controlled and double-checked in the most modern control furnaces available in order to insure the unfailing accuracy of every cone.

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Potters Supply Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (German Vallendar)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Micronized)
Porcelain Enamel and Mfg. Co.

Clay Miners
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Potters)
Denver Fire Clay Co.
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Process Equipment)
Lancaster Iron Works, Inc.
National Engineering Co.

Clay (Sagger)
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay-Slip (Albany)
Hammill & Gillespie, Inc.
United Clay Mines Corp.

Clay (Wad)
Kentucky Clay Mining Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Wall Tile)
Hammill & Gillespie, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Cleaners
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.

Cleaners, Chemical
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.

Clocks (Gauge Board)
The Hommel, O., Co., Inc.

Cobalt Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cobalt Sulphate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Colors
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. &. H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cone Plaques
Industrial Ceramic Products, Inc.

Cones
The Edward Orton, Jr., Ceramic Foundation

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Copper Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.

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Denver Fire Clay Co.
Norton Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

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Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Decorating Supplies
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.
National Engineering Co.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Porcelain Enamel and Mfg. Co.

Enameling Equipment (Complete)
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
The Hommel, O., Co., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Enamels (Porcelain)
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
The Hommel, O., Co., Inc.

Feldspar
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Denver Fire Clay Co.
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Flint
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.

Flint Pebbles
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

French Flint
Maxson, Elwyn L.
Paper Makers Importing Co.

Frit
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Fuel Oil Systems and Control, Stokers
Frazier-Simplex, Inc.

Furnaces
Carborundum Co. (*Carboradiant*)
Denver Fire Clay Co.
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Furnaces, Enameling
Swindell-Dressler Corp.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

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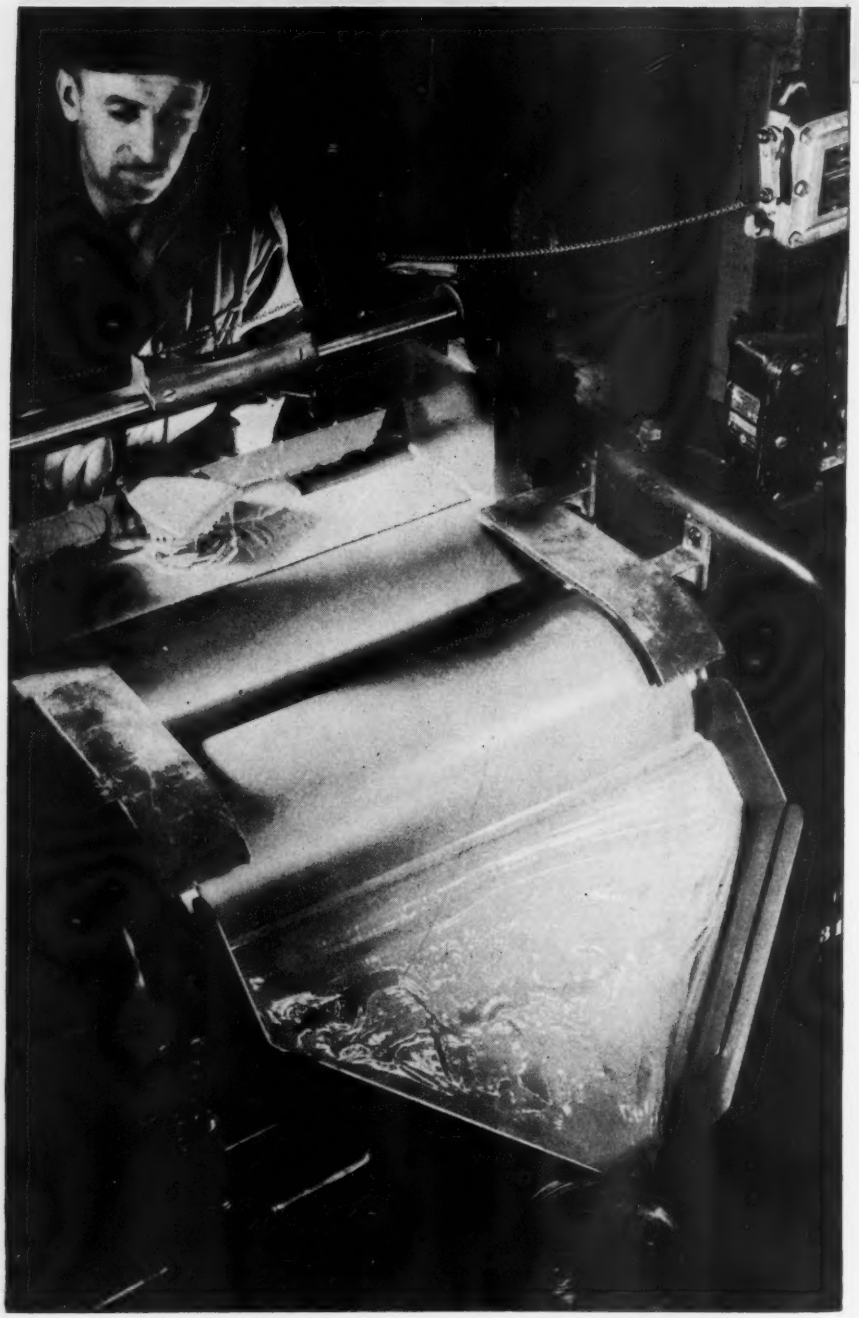
PUTTING THE SQUEEZE ON COLORS



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Georgia Kaolin
Modeling Clay

THE POTTERS SUPPLY COMPANY
EAST LIVERPOOL, OHIO

Clear the Lines for the War

Before you make a Long Distance telephone call today, ask yourself these questions:

1. Is it necessary?
2. Will it interfere with war calls?

The weight of war on the telephone lines is heavier every day. We can't build the new lines to carry it because sufficient materials aren't available. We've got to make the most of the service we now have.

Please give a clear track to the war effort by confining your Long Distance calls to those that are really necessary.

WAR CALLS COME FIRST

BELL TELEPHONE SYSTEM

H. C. SPINKS CLAY COMPANY

Miners and Shippers of

BALL, SAGGER AND WAD CLAY

NEWPORT, KY.

Puryear, Tennessee

August 1, 1942

Mr. Pete Potter

Comfortable Sanitary Pottery Mfg. Co.

Pottsville, U. S. A.

Dear Pete:

Yes we are busy, but we have ample facilities to ship even more tonnage!

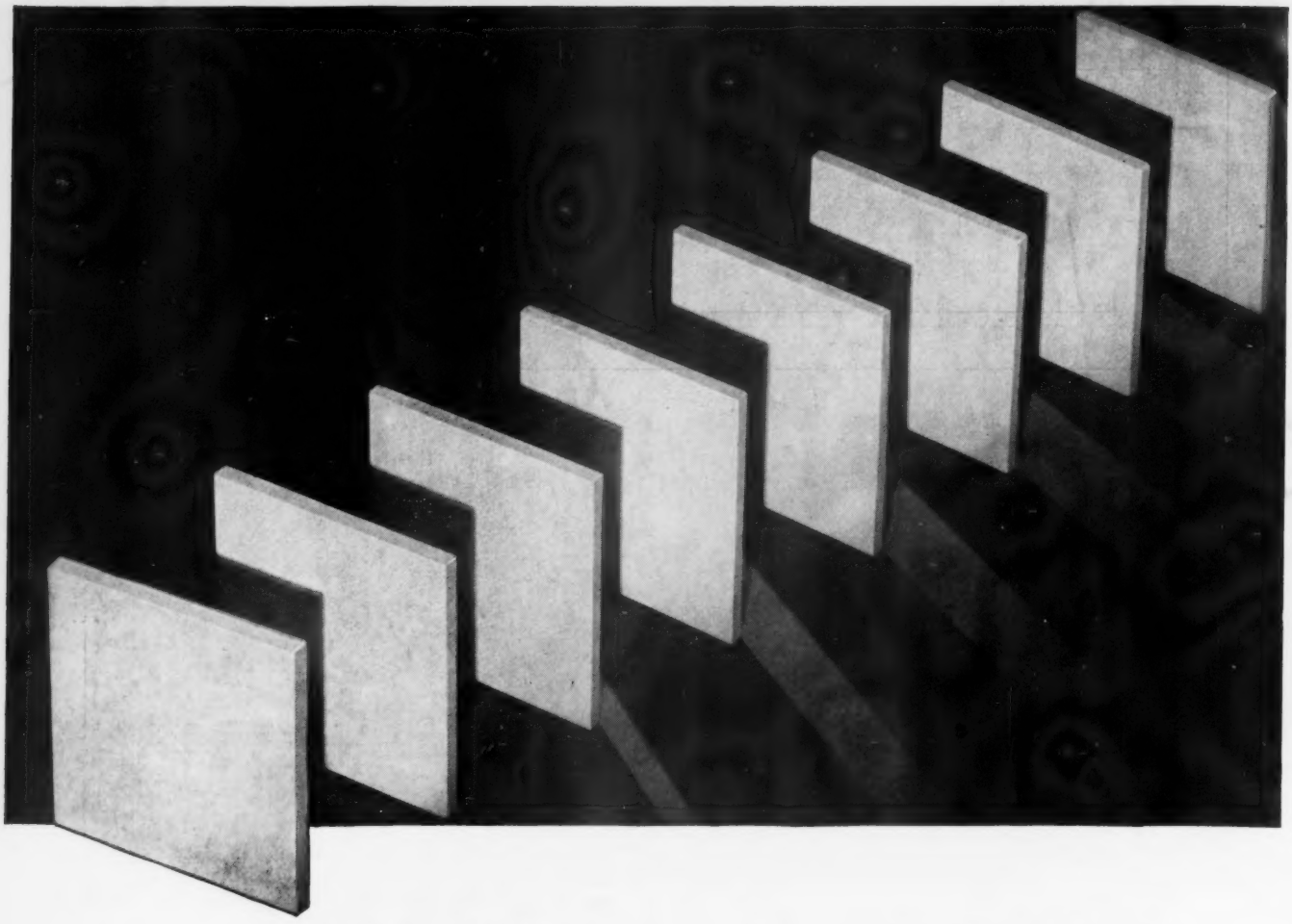
Your orders are appreciated.

Sincerely,

Dick Carothers

General Manager

H. C. SPINKS CLAY COMPANY



UNIFORMITY...

Uniformity in the production of glazes and porcelain enamels can sometimes be a baffling problem.

Our ceramic laboratory exists to help manufacturers find the solution—whether the cause be the right combination of ingredients or batch procedure.

The use of M & T Tin Oxide or Sodium Antimonate plays a large part in assuring not only uniformity—but a high degree of opacity, tensile strength, reflectance, surface hardness, and resistance to acid and alkali stains, as well.

Manufacturers' inquiries on any phase of porcelain enamel or glaze production will receive prompt attention.

TIN OXIDE

SODIUM ANTIMONATE

METAL & THERMIT CORPORATION

Ceramic Division

120 BROADWAY NEW YORK, N. Y.